

Mt. Etna Iron Works
One mile east of U.S. 22 on T.R. 463
Williamsburg
Blair County
Pennsylvania

HAER No. PA-224

HAER
PA,
7-WILL,
1-

DRAWINGS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

HISTORIC AMERICAN ENGINEERING RECORD

MT. ETNA IRON WORKS

HAER No. PA-224

Location: Approximately one mile east of U.S. Route 22 on TR 463, vicinity of Williamsburg, Blair County, Pennsylvania.

UTM: 17.738900.4489920

Quad: Spruce Creek

Scale: 1:24,000

Date of Construction: Initial construction of Etna Furnace occurred in 1807; additions to iron plantation occurred in the 1820s and early 1830s when several houses, including the ironmaster's residence and tenant house, were built.

Present Owner: Various private owners; the furnace stack is owned by the Blair County Historical Society.

Present Use: Private residences and agricultural endeavors.

Significance: Mt. Etna Iron Works was one numerous charcoal iron producers in the nationally renowned Juniata Iron region. This region was a leading producer of pig iron in the ante-bellum years. Mt. Etna retains a number of structures associated with this iron production, including the remnants of its stone-constructed blast furnace. Moreover, a number of residences and the company store, all related to the iron plantation, survive.

Historian: Christine Davis, Project Historian
Laura Sparks, Research Historian

Project Information: The historical research and writing for this project was carried out primarily in the summer of 1988. The intent was to produce a narrative history chronicling the furnace operations, as well as the activities of the owners and workers. The final draft of the manuscript was edited by Gray Fitzsimons and Ken Rose in 1993.

Acknowledgements: This report drew initially from research materials completed by Joy Zengel, Christopher Butcher, and William Cramer of the Williamsburg Heritage and Historical Society. These persons generously shared information they compiled on Etna Furnace and their cooperation was vital to the success of this documentation project. Others who aided in the documentation effort include George Drobnock of the Huntingdon County Planning Department, Alton Sternagle of Hollidaysburg, G. Robert Ganis of Tethys Consultants, and Bill Richardson, resident of Yellow Spring.

For more information, see Blair County and Cambria County, Pennsylvania: An Inventory of Historic Engineering and Industrial Sites, Gray Fitzsimons, Editor. Washington, D.C.: U.S. Department of the Interior, 1990.

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History:

"A visit to these works after night, when they are in full operation, causes one to think of old Vulcan and his assistants forging thunderbolts for Jove in their smithy under Mt. Etna."¹

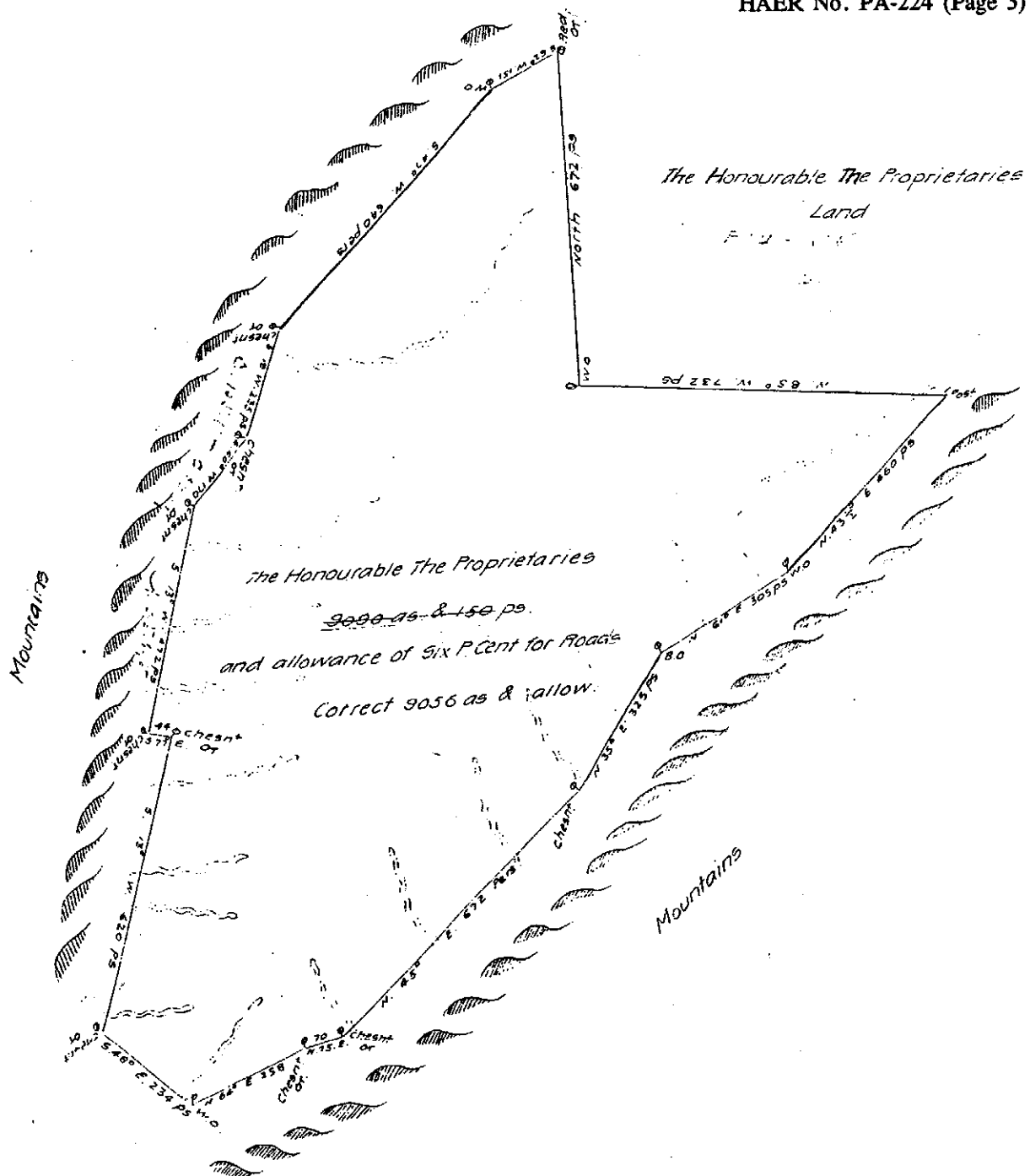
The Origins of Mt. Etna Iron Works

The richness of the Juniata Iron region was recognized before the American Revolution by the heirs of William Penn who reserved two large tracts of land north of Mt. Etna as soon as the original treaties for land acquisition were established. In the mid-eighteenth century, the Penn family retained thousands of acres of superior Pennsylvania properties by establishing "proprietary manors". Once the surrounding lands were sold, the reserved manor properties then commanded an even greater revenue for the Penns. The Mt. Etna region included part of a 9,056-acre tract of "well timbered limestone lands" known as the Sinking Valley Manor (see page 3). Adjacent to this property, the Penn family also surveyed the 5,913 acre tract known as the Little Juniata Manor in 1760 (see page 4). Both manors were eventually divided into lots and patented by individual settlers in the late 1700s. However, the Penns reserved the rights "to search for, dig, find and raise ores, minerals, or metals and to erect any houses, buildings, or works upon the land necessary for smelting, melting or refining same and to carry them away." As a yearly reminder of this right, the Penn family required their new owners to provide a fixed rent or quitrent each year amounting to "one peppercorn on the first day of March."² Much like the feudal system of the Middle Ages, the quitrent served to maintain the Penns interest in the lands.

In 1767, a company known as Juniata Iron Company, supervised by Benjamin Jacobs, first conducted surveys of the region's iron ore resources and timber tracts. The survey work was temporarily disrupted by the American Revolution. However, by the final years of conflict, the first iron works in the Juniata region, the Bedford Furnace and Forge, was erected by George Ashman, Edward Ridgley and Thomas Cromwell between 1786-7.³ Located near Orhisonia in Huntingdon County, the rich resources near Bedford Furnace continued to be used for the production of pig iron until the twentieth century.

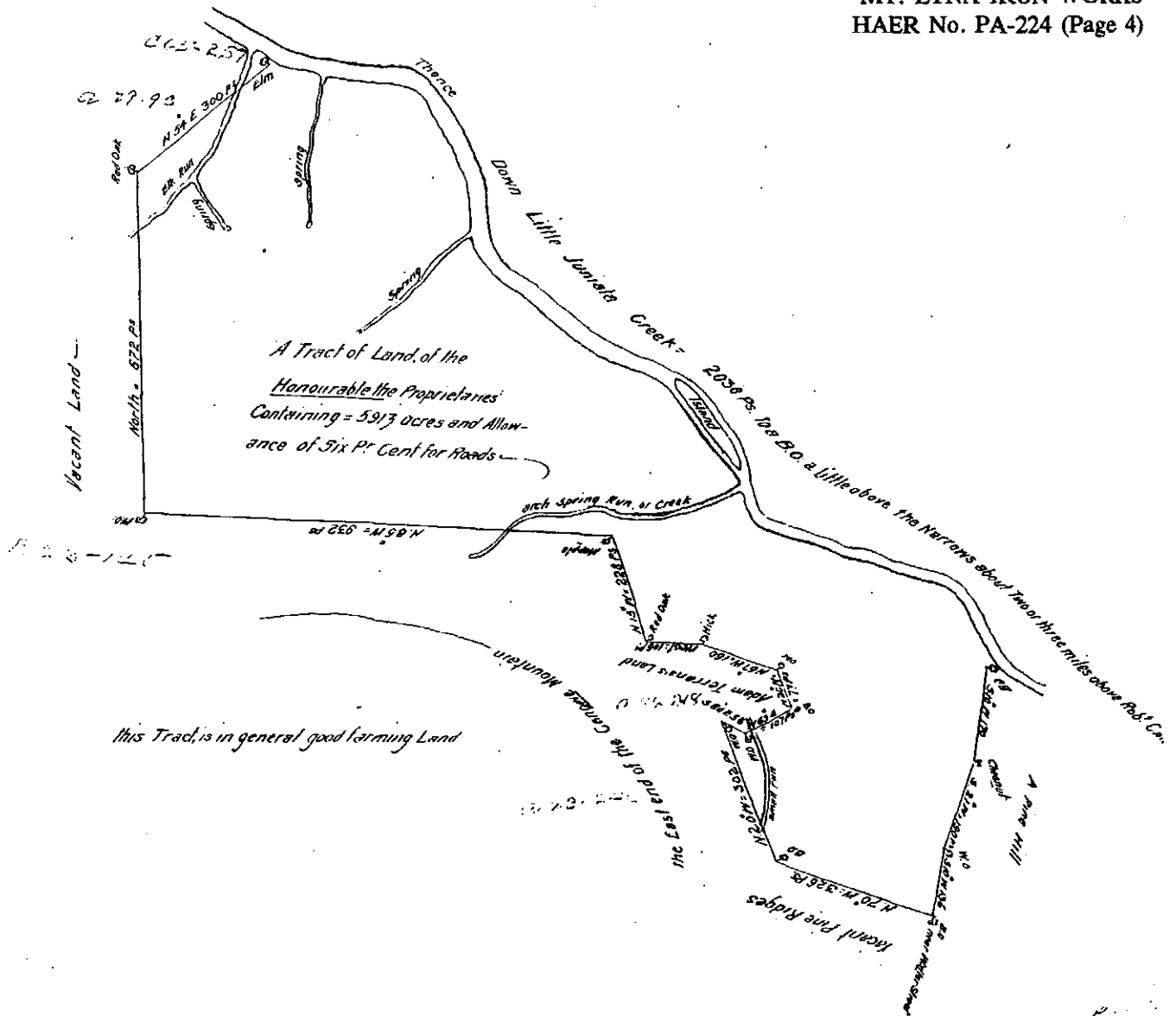
In 1809, American political economist Tench Coxe prepared the first American industrial census and, in his treatise on the nation's manufacturing, he encouraged iron masters to open more mines and expand production. Coxe additionally asked the ironmasters to augment their inventory of products to include "cutlery, fine tools, needles, watch springs and other nice wares". At that time, he believed there was "no limit to the fund of charcoal available in Pennsylvania for the production of iron. "Machinery to work up pig-iron and bars has been wonderfully invented, extended, diversified and multiplied. Each year enlarges and diversifies the iron and steel manufactures."⁴ New labor saving devices became particularly important in the iron industry where productivity required a large and expensive work force. At the forges, new water-powered tilt and trip hammers improved not only the quality of iron products but the speed with which they could be manufactured. Techniques for making iron wire, cannon, edge tools, and nails continued to be developed. But, even with new machinery, the methods involved in iron production still relied on the manual skills characteristic of a craft-based system.

During the eighteenth century, American iron masters failed to produce enough pig metal and bar iron to meet the demand, but by the opening years of the nineteenth century, the number of American iron furnaces began to increase rapidly. For twenty years following the Revolution, 150 new furnaces went into blast in Pennsylvania, and by 1806, 258,206 tons of iron was produced annually by the 167 operational furnaces.⁵ Fayette County in southwestern Pennsylvania led the state in the number of furnaces per county.



Sinking Valley Manor

Pennsylvania Archives, Third Series, Vol. IV, 1894.



Draught of a Tract of Land situate on the North Side of Frank's Town Branch, A Branch of Juniata River and Between Little Juniata Mountain, in Cumberland County: Containing Five Thousand Nine Hundred and Thirteen Acres, and the usual Allowance of Six Per Cent for Roads: Surveyed for the Honourable the Proprietaries November the Fourth Anno Domini one Thousand Seven Hundred to Sixty and Six: and the Honourable the Proprietaries Warrant Bearing Date the thirteenth Day of October Anno Domini one Thousand Seven Hundred and Sixty and Six.

by
John Lukens }
Surveyor General }

John C. ...

Little Juniata Valley Manor

Pennsylvania Archives, Third Series, Vol. IV, 1894.

By 1810, eleven furnaces, eight forges, three rolling mills and twelve naileries operated there. The Huntingdon County iron industry (including the area later divided into Blair County) thrived as the four charcoal furnaces, six forges, three naileries, two gun manufactories, and a rolling mill manufactured pig metal and iron products.⁶ In the early 1800s, Pennsylvania became America's largest manufacturer of nails, producing nine pounds of nails for each person in the state.

The first iron furnace constructed in the western part of the Juniata iron region was situated on Roaring Run, a tributary of the Juniata River. The origins of this early ironworks can be traced to June 23, 1792, when David Stewart, of Tyrone Township, purchased fifty acres on the Juniata River at the mouth of Roaring Run.⁷ Within a year, Stewart had moved to the site and constructed a grist and saw mill on the swift mill stream. The Commissioners of Huntingdon County approved a \$600 mortgage for Stewart's property and the mills he had constructed there. Structures located on the original mill tract included a small 22' x 28' barn, a 16' square cabin and a 8' x 12' springhouse. In addition, Stewart owned a 20' x 24' two-story loghouse and a small log springhouse.⁸ During the fifteen years that his mills served the needs of local agriculturalists, Stewart continued to acquire properties in Morris Township. By 1798, he owned a tract of Canoe Mountain timber and 275 acres of rich iron ore near Mt. Etna in the "Yellow Springs barrens".⁹

During the same period, another Huntingdon County merchant, John Canan, was also speculating on Juniata ore and timber lands. Born in Ireland in 1746, Canan had emigrated to America in the mid-eighteenth century with his parents, Moses and Hannah Canan. As soon as the lands in Huntingdon County were offered for sale, Canan and his family purchased iron ore tracts.¹⁰ While Canan continued acquiring property through the early-nineteenth century, he constructed merchant grist and saw mills at Hart's Log.¹¹

An association between Stewart and Canan developed when both men were appointed judges by Governor Thomas Mifflin in 1791.¹² Canan was also appointed Deputy Surveyor for the Huntingdon County Surveyor General, and David Stewart was serving as one of Canan's "sureties" in land appraisals as early as 1794.¹³ Canan and Stewart also possessed important political connections, with Canan serving as a state senator for the Bedford and Huntingdon district while Stewart directed the first board of Huntingdon County Commissioners.¹⁴ Through their surveying experience, both men became increasingly familiar with the availability of lands for farming and other raw materials. They were able to transact land purchases at bargain prices, and this business acumen more than anything else gave them the leading edge in the early regional iron industry.

It was David Stewart who secured the future for an iron works at Mt. Etna when he negotiated the purchase of 4,230 acres of timber and ore tracts known as the West and Russel mountain lands. These original warrants were contiguous, nearly rectangular plats of land covered with virgin timber of Canoe and Brush Mountains.¹⁵ While agriculturalists overlooked the area because of its steep terrain and poor soils, Stewart saw the timber potential for charcoal production.

Timber provided the essential charcoal fuel for the extraordinary consumption of both furnaces and forges. The cost of charcoal fuel consumed nearly half the budget for iron production.¹⁶ Once the high-yield virgin tracts were exploited, the cycle of reforestation began, with renewed forests available for charcoal production every twenty to thirty years. Nearly one acre of second-growth timber per day (twenty-five to thirty cords of wood yielded 800 to 1200 bushels of charcoal) fueled the average iron furnace operation.¹⁷

The Canoe Mountain tracts owned by Stewart were surveyed in 1794 under fourteen different surnames, however, the Land Office fees were paid by two eastern land speculators, John Barron and Ezekiel King. Barron and King subsequently divided the West tracts equally, each taking seven. Barron and King, like many other speculators, used the Wests as figureheads to divert attention from their names appearing repeatedly on land titles. When the West tracts were sold for taxes, David Stewart purchased eight of the warrants and two other adjacent tracts at a sheriff's sale in 1806. For these 4,230 acres, he paid the only \$44.18.¹⁸ The remaining seven Canoe Mountain tracts of 2,220 acres, were acquired six years later by the Mt. Etna Iron Works. Even though the land value had greatly increased, the timber lands still sold for the bargain rate of twenty-seven cents per acre.¹⁹

The Canoe Mountain properties remained a significant part of Mt. Etna Ironworks throughout its history. The thousands of acres of timber and ore holdings were a necessary investment and expenditure for the ironmasters because of the quantities of charcoal required for fuel, and because every ton of pig iron produced by the furnace required nearly three tons of ore. Mt. Etna's ore mines were located on the company's land tracts throughout the region. One large outcrop on the hillside northwest of the furnace was probably mined during the early years due to its proximity to the furnace. Ore was recovered from small pit mines in the Yellow Springs Barrens on Yellow Springs Creek and throughout the valley lands. Deposits on the steeper Canoe Mountain tracts were available, however, moving the heavy raw material required an additional transportation expense. Mining, collecting and transporting iron ore to the furnace was time consuming and costly, and Mt. Etna's brown hematite ores required a washing and shorting process before they could be utilized.

The year after he purchased the Canoe Mountain timber and ore tracts, construction of the Mt. Etna iron furnace on Stewart's Roaring Run mill tract began. Stewart selected an outstanding furnace site adjacent to the swift-flowing Roaring Run and its steep-sided valley. Water power to operate the bellows or blowing tubs was generated by the construction of a dam across the stream just above the furnace. Water was then diverted by a flume or raceway to the large water wheel adjacent to the furnace. A narrow terrace bordering the stream provided space for the casting shed while the contiguous cliff or charging terrace supported the charging bridge. In order to accommodate the furnace, excavations into the cliff face were completed and the face edges lined with stone. The earliest American furnaces utilized large wood and leather bellows up to 25' long and driven by water wheels powered by the adjacent stream. A tube connected the bellows with the tuyeres or nozzles through which the air was forced into the furnace (see page 7).

The irregular blast provided by the bellows system created problems. In 1762, Englishman James Knight patented double-cylinder blowing tubs which afforded a more consistent blast than the old bellows system. Two wooden tubs with interior pistons, joined by connecting rods, alternately moved up and down to force air into the blast pipe and through the tuyeres. A water wheel powered the pistons. By the late eighteenth century, many American ironmasters had installed this new technology, particularly at their forges.²⁰ By the time Mt. Etna furnace was constructed, the bellows system was becoming rapidly outdated and the use of blowing tubs may have provided the furnace blast at Mt. Etna.²¹ However, the term "bellows" continued to be used to refer to the tubs and other blast producing appliances.²²

In form, Mt. Etna Furnace was a truncated pyramid with rounded corners and an arch on three facades. This form contrasts to the straight-sided triangular arch varieties. The furnace's proportions were determined first by the available iron ore and timber varieties, and then by the ironmaster's preferences and previous experience. The dimensions of the arches were correlated with the interior or bosh diameters. Dolomite from the Lower Ordovician Nittany Formation formed the furnace walls, and wooden beams and iron tie rods were attached to the stack to secure the ²³ After the exterior stonework was completed, the



J.H. Isett Survey of Mt. Etna, October 30, 1901
plotted on the Spruce Creek 7.5' U.S.G.S. Quadrangle

Williamsburg Heritage and Historical Society Archives.

(A - Furnace Tract)
(B - Forge Tract)

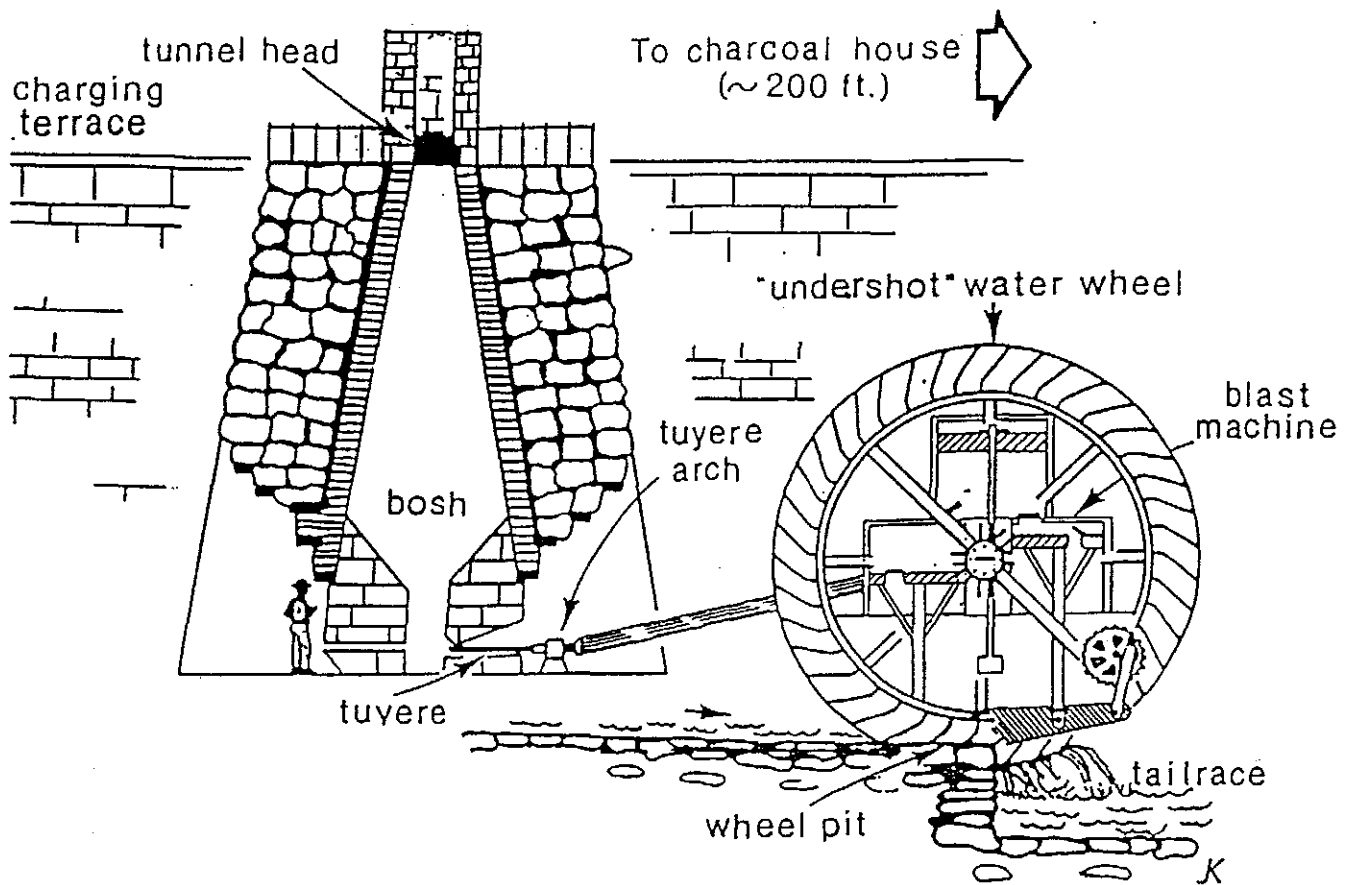
interior and bosh were constructed of fine-grained limestone or sandstone and separated from the exterior by clay, sand or rubble to allow for expansion.²⁴ Laying the hearth stone on the furnace floor was a specialized task and required the use of high quality sandstone. A skilled worker carefully laid the cut stones to furnish an air tight wall around the furnace core. Iron bars were then applied to secure the hearth to prevent damage by heat expansion. Furnace construction required the skills of experienced masons. Most of the masonry work in the Juniata region was apparently completed by workers from the eastern coastal regions who were skilled in charcoal furnace technology. Even as late as the 1830s, Juniata ironmasters continued to employ the skills of Chester County masons for "raising the stone, cutting and laying it ready for blast".²⁵

The furnace charge, consisting of measured baskets of limestone, charcoal, and a mixture of several types of iron ore, was fed into the tunnel head at the top of the stack from a level ramp attached to the cliff. At the nearby Mary Ann Furnace on the Raystown Branch of the Juniata, fifteen hushels of charcoal, thirty pounds of iron ore, and one basket of limestone were thrown in the furnace every ninety minutes. High quality limestone or gabbro provided a flux to ameliorate the reduction process. If the flux was of poor quality, low grades of iron resulted. The temperature during the smelting process could be determined by the "color and sparking of the metal."²⁶ The ironmaster experimented until he knew the precise blend of raw materials to make the highest quality of iron.

"Blowing in" the furnace required at least several days and sometimes a week. First the stack was filled with charcoal and hurned until fire appeared at the tuyere arch. New charcoal was added, and gradually iron ore and limestone were introduced. The furnace's "campaign" or period of yearly production, usually lasted nine months although several Juniata ironmasters reported that they continued operation nearly all year. Even though materials were stockpiled in preparation for the winter, production was sometimes suspended when transportation of raw materials and finished iron commodities became difficult during bad weather. At some furnaces, it was the summer's heat that ended the campaign. Each year, the cold hlast furnace had to be "blown out" in order for repairs to be conducted. Excessive heat at the air-tight core and hearth reduced the sandstone walls and gradually increased the core opening until it was too large. When the furnace was blown out, the masonry around the core and hearth was reconstructed.

Although no direct evidence of the ancillary wooden structures attached to Mt. Etna's furnace has been located, an examination of similar furnaces can provide some indication of their placement. Refurbishing and reconstruction often took place at the iron works, particularly when ironmasters shifted to the hot blast method. Mt. Etna may have been modeled after the Huntingdon Furnace built in 1796 by German ironmaster, George Anshutz. This early cold blast furnace pre-dated Mt. Etna and was later operated by George Shoenberger. As did Mt. Etna, the furnace later converted to the hot-blast method.²⁷ Another similar furnace, the hot blast Laurel Hill Furnace, was established in Westmoreland County in 1845-46 by Reed, Gallagher and Hale. The Frankstown Furnace, built in 1836 as a cold blast operation, also had a massive front arch and three smaller arches. Here the casting house, the blowing house for the hot hlast machinery, and other buildings were attached to the sides of the furnace rather than the front (see page 9).

Mt. Etna's partners also owned rich agricultural lands where food was grown for the iron workers as well as for the horses that hauled raw and finished materials. When Mt. Etna went into blast into 1808, eleven horses were being used, and within three years, the ironworks owned 25 horses.²⁸ Typically, teams of four horses carried raw materials to the furnace. One to one-and-a-half tons of ore could be carried in each wagon, but, horse-drawn wagons were not seasonally dependable.²⁹ Rain, snow, and steep slopes



"Generalized drawing of Mt. Etna Furnace as it may have appeared in its early 'cold-blast charcoal' period."

Inners, Jon D., Mt. Etna Iron Furnace Plantation, Blair County, Pennsylvania Geology, 1986.

greatly reduced the efficiency of the animals and the predictability of the furnace to produce iron. Without the necessary raw materials, the furnace went off blast and took several days to recharge. It was not until the late 1830s, that the more efficient mule teams replaced horses at the ironworks.

Maintaining the wagon trains was a major expense. Horses not only required the services of the farmers who produced corn, hay and oats, but also the blacksmith and harnessmaker. The cost of wintering the animals and constructing stables for them was an additional obligation. Wagonmakers built and maintained the wagons that had been overburdened by their heavy iron cargo. Harness oils, grease, candles, and matches commanded an additional cash outlay in the transportation budget. Due to these expenses, it cost nearly twice as much to deliver the pig iron as it did to produce the commodity.³⁰

Consequently, transportation issues were of great concern to the Juniata ironmasters. "The most important and frequently traveled" route through the Juniata region was the old Frankstown Indian Path.³¹ To provide a link between the navigable waters of the Susquehanna River with the Ohio River drainage, the Frankstown Path had been improved for wagon travel by 1789. Another branch of the road was developed at the Conemaugh River near Johnstown to connect the rivers during the navigable season.³²

Major improvements to the Frankstown Path commenced shortly after 1807, when the Harrisburg, Lewistown, Huntingdon, and Pittsburgh Turnpike was authorized. The section of this turnpike near Mt. Etna extended from Blair's Gap to the west side of Laurel Hill. David Stewart served on the board of this local Turnpike company, and was the secretary in 1817.³³ According to a contemporary account, these "permanent roads" were "worthy of the epithet 'Roman' so solidly formed and constructed at so much expense ... and must not be confounded with the hastily and so extensively made in new England and New York."³⁴

Etna Iron works was particularly well situated since the new road passed to the west of the site while the Juniata River flowed to the east. A road between the newly built furnace and the Frankstown Road was constructed soon after the furnace was built so that Etna's pig iron could be shipped to market. The shipment of goods on the river was seasonally limited and, during this period, keel boats normally traveled only as far as Waynesburg (McVeytown) where wagons carried goods for the remainder of the journey.³⁵

With improved road systems, the western markets, particularly at Pittsburgh, were rapidly expanding. From 1801 to 1817, Pittsburgh's market had tripled.³⁶ Juniata bar iron however remained a "scarce" commodity in Pittsburgh during the fall of 1815 and the spring of 1816 with only an average of 210 tons arriving per month.³⁷ Nails and other hardware for building construction as well as horseshoes, axes, and wagon tires were in great demand throughout the frontier regions. Because iron products were so scarce on the frontier, abandoned structures were often burned in order to salvage nails.³⁸

Among the most important products at an iron works was the iron bloom. The first blooms of Mt. Etna pig iron may have been hammered at Cove Forge, a charcoal forge owned by John Royer. Cove Forge went into operation in the same year as Etna Furnace and was located several miles upriver. The need for a road between the forge and furnace was recognized as soon as both enterprises were established at the end of 1808. Local inhabitants "labored under great inconvenience" for a road between the mouth of Clover Creek at Cove Forge to David Stewart's mills on Roaring Run. Gradually, a network of primitive roads was developed to link furnaces to forges. Mt. Etna's iron was shipped on these roads to area's various forges and mills throughout the 1810s. One likely recipient of Mt. Etna iron was the new rolling and slitting mill at Birmingham located in Tyrone Township.³⁹

Although the potential for profit was excellent at the Mt. Etna iron works, the risks and uncertainty of early nineteenth-century ironmaking necessitated formal agreements. According to a Huntingdon County deed the partnership agreement among David Stewart, John Canan, and William Moore was initiated on December 20, 1806, two years before the furnace went into blast.⁴⁰ Operating under the name of David

Stewart and Company, the three partners subsequently developed the iron works by constructing a charcoal forge⁴¹, a stone blacksmith shop⁴², a small stone ironmaster's house, and other tenant houses, stables, and ancillary structures.

Once the unrefined pig iron had cooled at the furnace, it was shipped to the forge where pigs were fabricated into blooms. At the forge's refinery or finery hearth, pigs were heated to a semi-molten condition, hammered with a water-powered hammer and then reheated and hammered into anconies or blooms. Massive wrought or cast iron hammers mounted on oak beams were powered by large water wheels, at least 25 feet in diameter. Water wheels also powered either the large bellows or blowing tubs that supplied the blast for the forge. In the early years of the Juniata iron industry, blooms were the commercial medium of exchange produced at most forges and sent to Pittsburgh rolling mills. "Blooms are rough blocks of iron about four inches square, by two feet in length, wrought at a single heat under the forge hammer. They are rapidly manufactured, are of convenient carriage, and lose but little in subsequent manufacture."⁴³ At some forges, the blooms were heated at a chafery hearth and then hammered and cut into standard lengths known as bar iron.

As Mt. Etna prospered, the western Juniata industry evolved into a nationally recognized iron region. In these early years, the pioneer families of the industry, including the Isetts, Shoenbergers, Lyons, and Royers remained prominent in the iron industry, despite its boom and bust nature. These families had acquired iron properties in the late-eighteenth century when Juniata land was abundant and relatively inexpensive. Their extensive land holdings were largely responsible for their success and longevity in the region. When the iron industry was depressed, they turned to milling and agriculture for the principal source of income.

At the time the Mt. Etna partners were planning their new iron works, only one furnace, Huntingdon Furnace built near Spruce Creek in 1796, was in blast in Huntingdon County. By the end of the eighteenth century, individuals who would long be associated with the Juniata iron industry were successfully producing blooms or bar iron at several forges in the county. These pioneer ironmasters included Greenberry Dorsey, John Lyon, Anthony Shorb, and George Shoenberger.⁴⁴

Despite the financial success of some of number of the region's iron masters, the nature of the early iron industry was characterized more by its many failures. The crisis following the War of 1812 depressed the industry for nearly a decade. John Canan and his son had gained full control of the Etna Iron Works during the war, but an accumulation of debts resulted in the disposal of Canan's Mt. Etna holdings at a sheriff's sale in 1819.⁴⁵ Other local iron works suffered a similar fate, with the Union Furnace and Sligo Forge failing during the same period.⁴⁶

Canan was able to retain one-third of the works, with David Stewart acquiring a one-third partnership, and Thomas Jackson (who had married into the Canan family in 1812) buying out the other third upon the death of Barree Billie Moore. Finally, in 1821, John Canan, the former frontier leader and ironmaster, declared himself an "insolvent debtor" and petitioned the court for relief.⁴⁷ The following year,

Canan sold his interest in Mt. Etna to Thomas Jackson who now retained the controlling two-thirds interest in the works.⁴⁸ Canan died in 1831 and was buried in the family cemetery near his old mills at Alexandria. However, he lived long enough to see Mt. Etna become an important iron works under the management of Henry Spang.⁴⁹

The Spang Years: 1823-1851

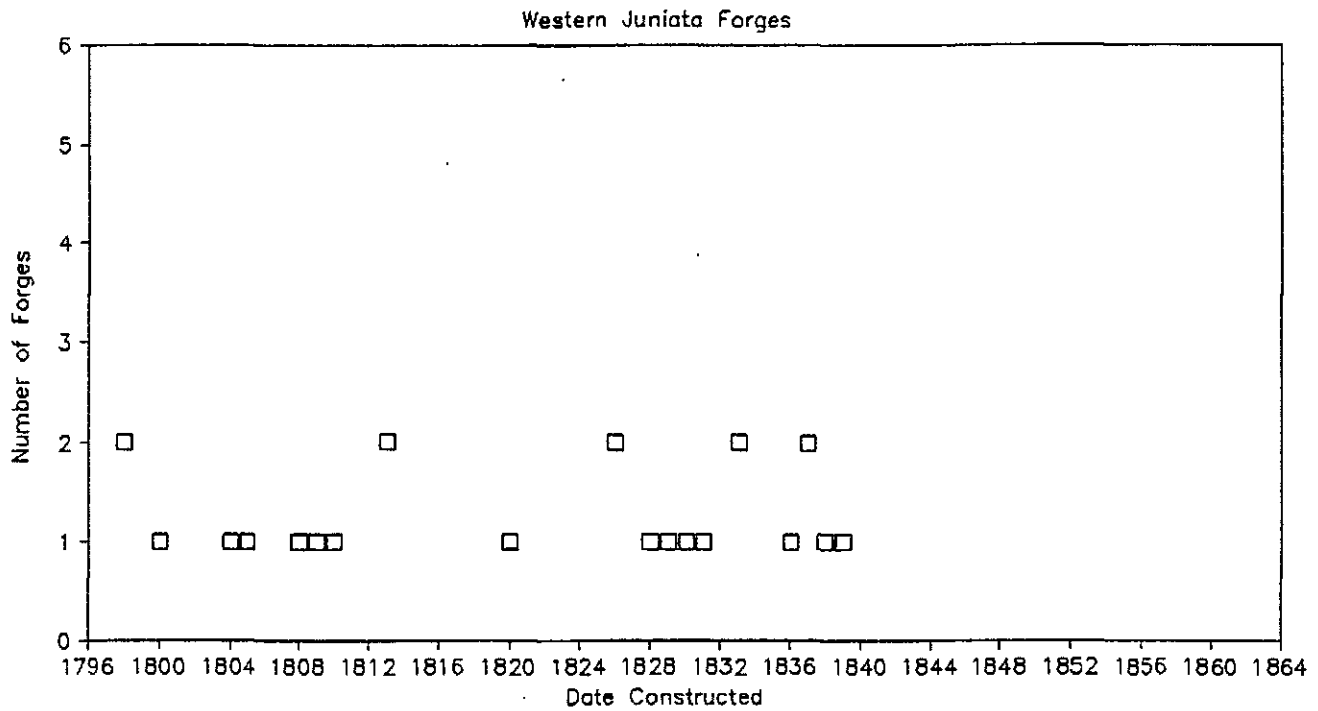
Before the Revolution, the Henry Spang family had established an interest in the production of the charcoal iron, and in 1780 Frederick Spang built a small forge with two fires and one hammer at Oley. Henry S. Spang inherited the Oley Forge and managed the property until he moved to Huntingdon County in the early nineteenth century. His brother, Jacob S. Spang, took over the property and later expanded the works with a cold blast furnace built in 1835.⁵⁰

Henry Spang and other eastern ironmasters became intrigued with the Juniata Valley when the concept of a canal through the region showed signs of becoming a reality. Not only did the valley offer the rich resources necessary for iron production, but a series of blast furnaces and forges had already been constructed there. Merchants with experience in the iron industry recognized the tremendous economic potential of the valley once the prolific western markets were opened up by canal transportation. Furthermore, because the region had not economically recovered from the Panic of 1819, excellent real estate values could still be negotiated.

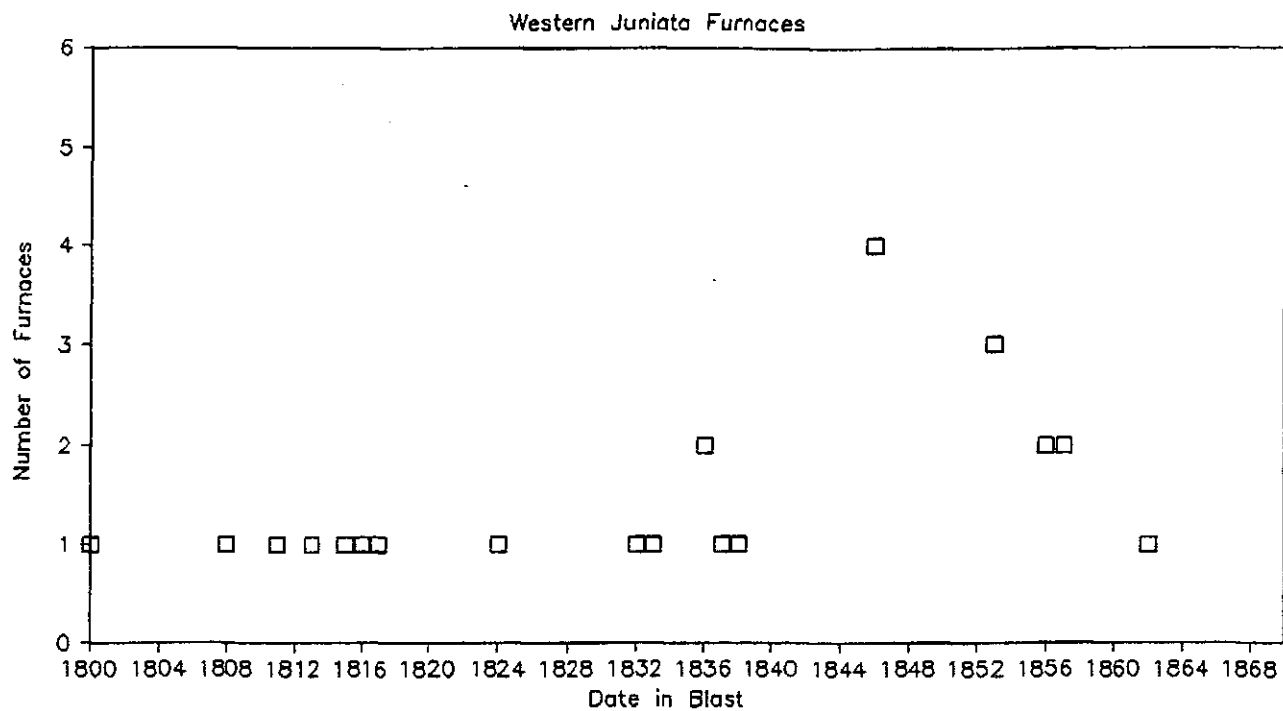
Through a series of deeds dated from 1823 to 1824, Henry S. Spang and Henry Fisher of Berks County acquired the Mt. Etna Iron Works for \$24,000.⁵¹ The partners immediately began purchasing Catharine Township ore rights and additional land tracts but, a few months after their partnership agreement, Fisher died.⁵² In the fall of 1825, the public sale of Fisher's partnership was held at Mt. Etna Iron Works, and Henry Spang turned in the "highest and best bid."⁵³ Spang manufactured iron at Mt. Etna from 1823-1828 with little evidence of any major changes.⁵⁴ The furnace produced a modest 600 tons of pig iron from which the forge fabricated nearly 300 tons of blooms per year. Along with the production of iron, the merchant milling enterprises made up a significant proportion of Mt. Etna's business.⁵⁵

Before the building of the Pennsylvania Canal, products in the Mt. Etna region were shipped by two methods - overland road travel or by "arks" which floated east on the Juniata River. Teams for overland road travel were provided by local farmers who hauled products for themselves and their neighbors during off-seasons. River transport involved the accumulation of products until annual floods could carry the arks over the shallow waters of the Frankstown Branch. Of the eighty-two arks in Huntingdon County, only six to ten carried pig metal and bar iron; the rest were laden with grain, flour and whiskey. Mt. Etna shipped iron blooms fabricated at the forge, grain and flour from the grist mill, and lumber sawn at the sawmill. These products either commanded a cash payment or were exchanged for goods. By this time, Pittsburgh had become the most important western market, although delivery to the west cost nearly double that of eastern transportation. But, after paying a shipping cost of \$25 to 30 per ton, the Pittsburgh market paid \$100 to \$115 for iron while the eastern markets compensated the ironmasters only \$85 to 95 per ton.⁵⁶

Both river and overland transportation methods required the storage of goods for long periods, and it could be many months before the ironmaster received a profit from his expenditures. Thus, self-sufficiency at the early nineteenth century iron works was critical. Raw materials for iron making were procured on company tracts; employees farmed company lands. With improved canal transportation, however, the iron works could depend on a more rapid cash flow and a semblance of security. The construction of new forges



Western Juniata District: Forges constructed from 1796 to 1864



Western Juniata District: Furnaces constructed from 1800 to 1868

indicated that the depressed iron industry was recovering, and beginning in 1826 new charcoal forges were built almost every year, reaching a peak construction period in the early 1830s. Most of the new forges were associated with existing iron furnaces and built by experienced ironmasters like George Shoenberger, Edward Bell, and John Royer. Only one new furnace, the Bald Eagle, was built between 1817 and 1832, as the older furnaces slowly returned to operation.⁵⁷ During the year of 1822, Jackson and Stewart may have reconditioned Mt. Etna furnace and placed it back in blast.⁵⁸ Although tonnage at most of the charcoal furnaces and forges increased gradually during this period, the industry's technology remained relatively static. This increase partially resulted from important changes in labor management that involved incentives and a more efficient use of time.⁵⁹ Rather than a fixed wage, Mt. Etna foremen and founders were now paid by the ton, and wood choppers by the cord. Such incentives increased production and skills at the iron works. With the exception of some "public works", Spang believed that the average rate of wages, \$22 per month, was higher than any other business.⁶⁰ Along with high wages, workers lived in company houses and probably used some adjacent land for gardening. Innovative transportation technology including the Pennsylvania canal system and the new tram railways also allowed the industry to expand.

With the security of canal transportation in his back yard, Henry Spang began to expand at Mt. Etna Iron Works in 1827. Most importantly, during the next five years, Spang linked his iron works to a large rolling mill in the Pittsburgh area, an operation which he established in 1828. Mt. Etna residents witnessed a building boom with the construction of a blacksmith shop, an ironmaster's house, a company store, a barn, and a grist mill. The population of Morris Township grew along with this expansion of Mt. Etna: from 807 persons in 1820 the census recorded 1043 residents by 1830, an increase of fifty-one per cent.⁶¹

As laborers cut the stone and crafted woodwork for Spang's new ironmaster's house, Irish workers dug the canal prism across the road. The new mansion house was oriented to the Canal and a newly constructed warehouse used to store products. Spang also established a stone company store located near the furnace in 1831.⁶² Based on construction technique and architectural features, both the tenant house and bank barn were constructed during this period as well. By this time, Spang employed 150 workers and estimated that he owned between forty and fifty workers' houses at Mt. Etna.⁶³ Three log houses now standing near the old forge site represent one example of the range of styles of workers' housing that composed the iron works community. (Recently the fourth log house in the row, a double house, burned.)

Spang's stone three-and-a-half story stone grist mill with overshot wheel stood at the juncture of Roaring Run and the Juniata River. An adjacent sawmill at the mouth of Roaring Run was supplemented by a new mill located in the center of the Canoe Mountain timber tracts on Canoe Creek.⁶⁴ Transportation between the furnace and the forge greatly improved when Spang constructed a tram railroad along Roaring Run.⁶⁵ Before the invention of the T-rail in 1830, such trams maneuvered on stone rather than wooden ties and were pulled by horses. Stables and barns for the fifty horses used both for "teams and for farming" were another important site component at Mt. Etna. The number of animals owned by the iron works more than doubled from twenty horses, two cows, and two oxen in 1823 to forty-two horses, six cows, and six oxen in 1827. Twenty years later, however, a significant change in the use of work animals occurred when, by 1846, Spang had purchased thirty-one mules to haul raw materials. At that time, the number of horses was reduced from forty-four to twenty. As replacements for horse-power in the industrial sector of Mt. Etna, mules proved to be more efficient beasts of burden. They continued to be employed until the iron works closed in the 1877. However, horses remained in use on the tenant farms and railroad and certainly to transport the ironmaster's about in his pleasure carriage.⁶⁶

For a short period, two forges with a total of five fires generated blooms at Mt. Etna.⁶⁷ Spang may have eventually constructed a "modern" forge to replace the original one built by Stewart, Canan and Company in 1811. When surveys for the canal were first conducted in 1826, it was damage to the race for this forge that caused concern for both Spang and the canal commissioners. According to a letter to the Canal Commissioners from Joseph Riter, Juniata Division supervisor in 1840, the forge dam was located "midway of the level between Locks 20 and 21. Considerable difficulty has been experienced last season with the lock keepers above and below in keeping the level (level) in order."⁶⁸

In 1832, Spang estimated that his investment in Mt. Etna's lands, buildings, machinery, and water power at \$70,000, with annual expenses running at \$35,000. From 1828- 1832, profits at Etna Ironworks were less than six per cent, a fact which Spang attributed to the low market price of iron and the increased cost of producing pig metal, particularly the cost of wages. The yearly increase in the price of grain, the difficulty of mining ore and coal, and the great distance to haul the raw materials "from off the rough mountains" further contributed to the low profit margin.⁶⁹ Even so, the iron works' success afforded Spang luxuries available to few other Morris Township residents.

Pennsylvania Canal at Mt. Etna

When construction began on the new Erie Canal in 1819, southern Pennsylvania businessmen and politicians recognized that this continuous waterway between the Atlantic seaboard and the Great Lakes would jeopardize the economic growth of the entire region by diverting trade to the potentially more efficient northern route. As the mid-west opened for settlement, an attractive market for Pennsylvania products was rapidly evolving in such states as Ohio, Indiana, and Kentucky. Because these markets were located farther from the highly competitive foreign and eastern iron producers, Juniata iron masters recognized the essential value in establishing connections with the west. Since the Juniata River flowed to the east, transportation to the prolific western markets had been limited to expensive and time-consuming road travel. The price of transporting goods was high and accompanied by a lengthy time between shipment and payment for goods received. When Ohio began plans for a canal to connect with the new Erie Canal -- a system which would further increase the range of the trade route to include nearly every point on the western waters -- an additional threat was posed. Plans to generate feasibility studies for the Pennsylvania Mainline Canal commenced in 1823.

By this time, property owners living along the proposed canal line were keenly aware of the change such a new transportation system would make. Any commercial enterprise located on the canal route had ready access to the most efficient route to western consumers. Tremendous potential existed for the Juniata iron furnaces and forges even though some ironmasters were still recovering from the Panic of 1819.

Recognizing an opportunity for success, Henry S. Spang purchased the Etna Iron Works in 1823 just as the general route for the canal was under consideration. In 1819, he had fortuitously purchased land near Pittsburgh, also located adjacent to the proposed canal route.⁷⁰ When the state's surveyor performed the initial surveys for the canal, he noted the Etna Iron Works on the hill close to water and penciled in a comment that "Spang's furnace race" was located at the mouth of Roaring Run. At this point, the Juniata River terrace was seven feet above the water.⁷¹

The canal surveys were completed, the route selected, and actual construction authorized on February 26, 1826. The Juniata Division of the Pennsylvania Mainline Canal extended from the junction of Duncan's Island on the Susquehanna River to the Basin at Hollidaysburg for a total length of 127-1/2 miles. Mt. Etna was located on the Frankstown Line of the Juniata Division which terminated in Hollidaysburg. Completing

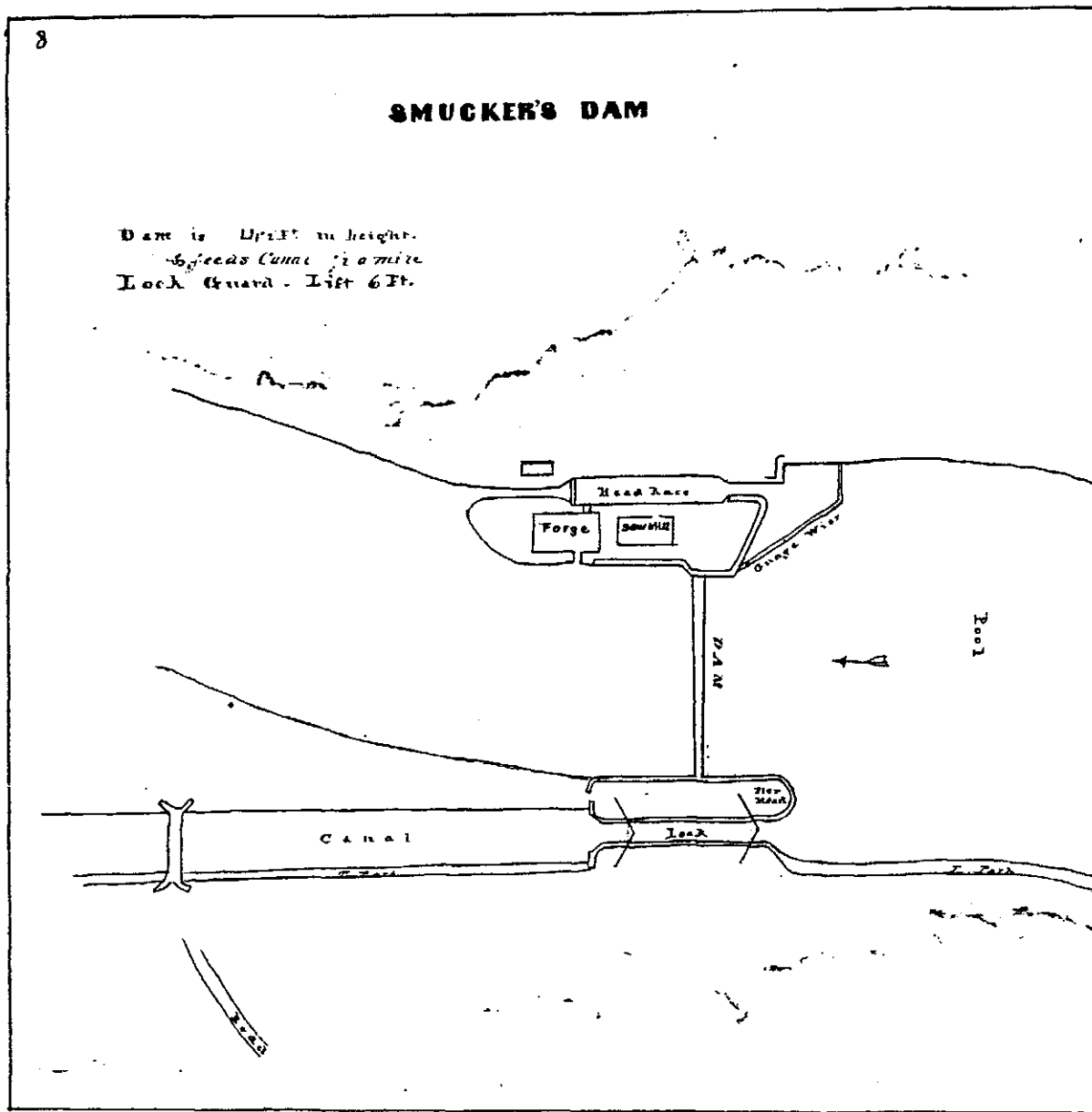
the connection from Hollidayshurg to Johnstown, where the Western Division of the Canal originated, was the Allegheny Portage Railroad. Short feeders connected the canal to the west branch of the Bald Eagle Creek and the Raystown branch of the Juniata River.⁷²

Although the canal's significance to the Juniata Iron industry was unchallenged, some reservations regarding the physical impact of construction were advanced. Spang from Mt. Etna, Peter Shoenberger from the Juniata Forge near Petershurg, and Royer and Schmucker from Cove Forge all owned properties that were sited on the floodplains through which the canal would pass (see page 18). The four proprietors expressed concern for their iron works and the potential damage the canal construction might cause. In Spang's case, the canal would bisect the race that provided waterpower for his forge, and a culvert or aqueduct would be necessary to span the waterway. His concerns were understandable. In a letter to the Canal Commissioners, the ironmasters proposed the radical solution of extending the Allegheny Portage Railroad past Mt. Etna to Petershurg.⁷³ However, this proposal was never seriously considered. Canal Engineer Edward Gay did express his concern that during periods of high water, the operations at Royer's Forge would be "retarded, if not entirely suspended as the sheeting of the water wheel is but one foot above the surface of Pool #5. The injury, however, cannot be avoided unless by raising his dam and water wheel about 2 feet", an action Gay believed would prove too difficult.⁷⁴

The canal at Mt. Etna entered the property to the south near Sissler's farm by means of a guard and lift lock connected to a dam (see page 19). The canal continued on the west side of the river, past the ironmaster's house (see page 20), and continuing under the aqueduct for the forge's race. The canal then passed over the Juniata River via a long wooden aqueduct with three stone piers. At this point, the canal made a sharp right bearing and crossed the floodplain to the opposite bank of the Juniata (see page 21). Four locks and an associated lockhouse were located in this area, and a waste weir cut into the adjacent bank to hold surplus water (see page 22). By crossing the river here, a compromise was reached. A section of the canal was eliminated and "the iron works of Mr. Spang will be saved". This relocation also bypassed the rocky bluff at the mouth of Roaring Run, "difficult either for a canal or towpath."⁷⁵

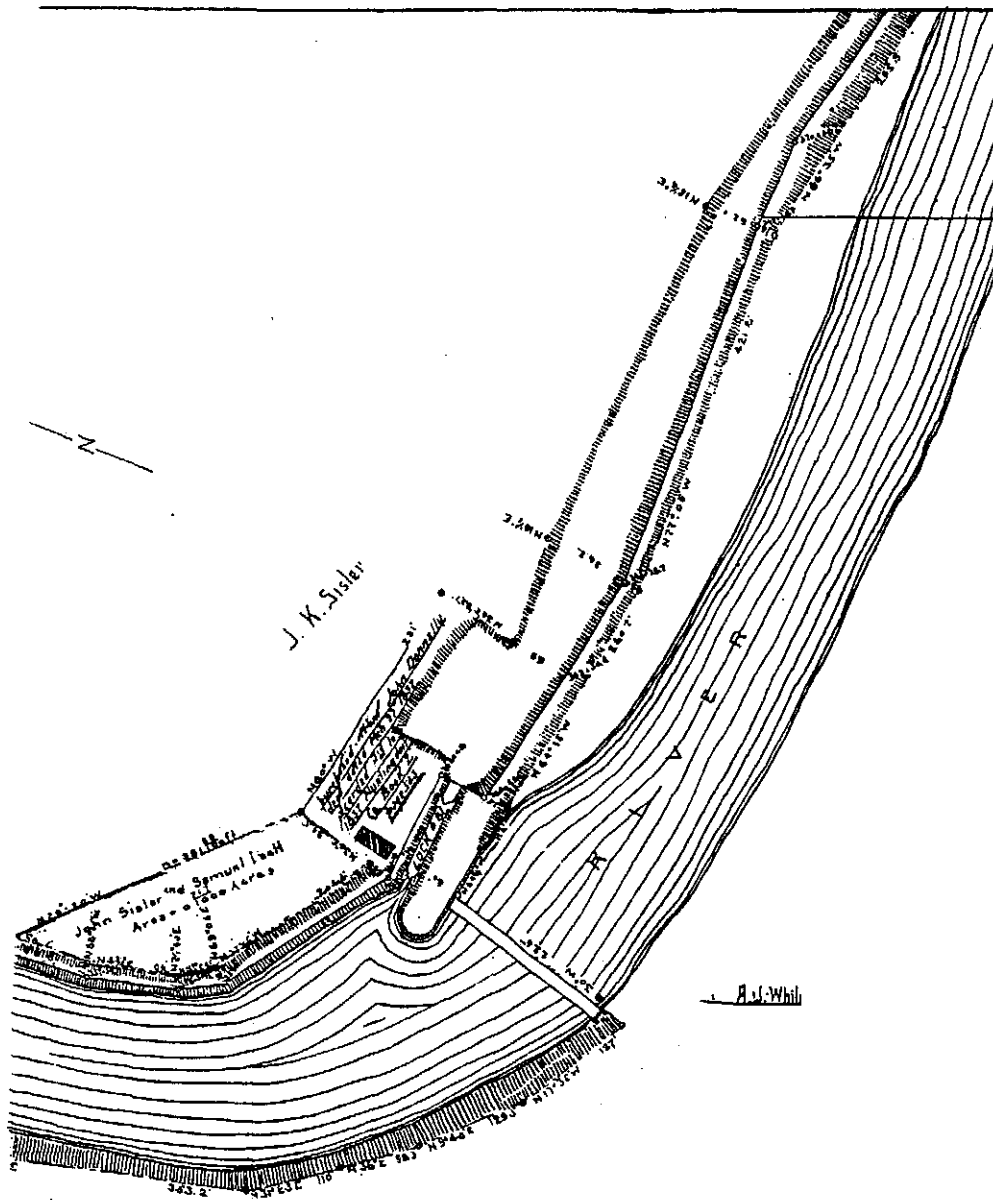
Canal construction required the skills of many engineers and workers during a time when, due to a national labor shortage, such a force was difficult to obtain. Because of this dearth of skilled workers, large contracts were awarded through the patronage system, as political favors. Many private local companies, including one organized by Henry S. Spang, successfully negotiated contracts to provide the necessary construction materials and labor for the canal. Spang, Royal Hopkins, Vincent White, and McMason, under the firm of Spang, Hopkins, and Company, furnished all the materials and labor for construction of Aqueduct #4 at Mount Etna, and also constructed Locks number 21 and 22. In addition to providing canal contracts for local companies, the actual construction of the mainline required the purchase of many local commodities particularly iron, stone and lumber. A single Juniata aqueduct required over 2,000 pounds of iron including suspension rods, plate stops, and bolts.⁷⁶ The Mt. Etna blacksmith shop and sawmill may well have provided many of these wrought iron and wooden materials.

By the fall of 1832, the canal features had been completed and the Mainline nearly ready for regular shipping and travel. On Tuesday, November 28, 1832, the superintendent of the Juniata Division, the principal engineer, and a group of "ladies and gentlemen" stepped into the first canal or packet boat on its way from Huntingdon to Hollidayshurg. Along the route, a cannon aboard ship volleyed in response to salutes fired by supporters. In the evening, houses were illuminated as the packet negotiated the canal locks and aqueducts for the first time. The boat crossed Spang's aqueduct late in the evening and arrived in Williamshurg at ten o'clock at night. Public meetings, receptions, ceremonies, and speeches acknowledged the remarkable technological achievement.⁷⁷



Smucker's Dam indicating Cove Forge and Royer's Saw Mill.

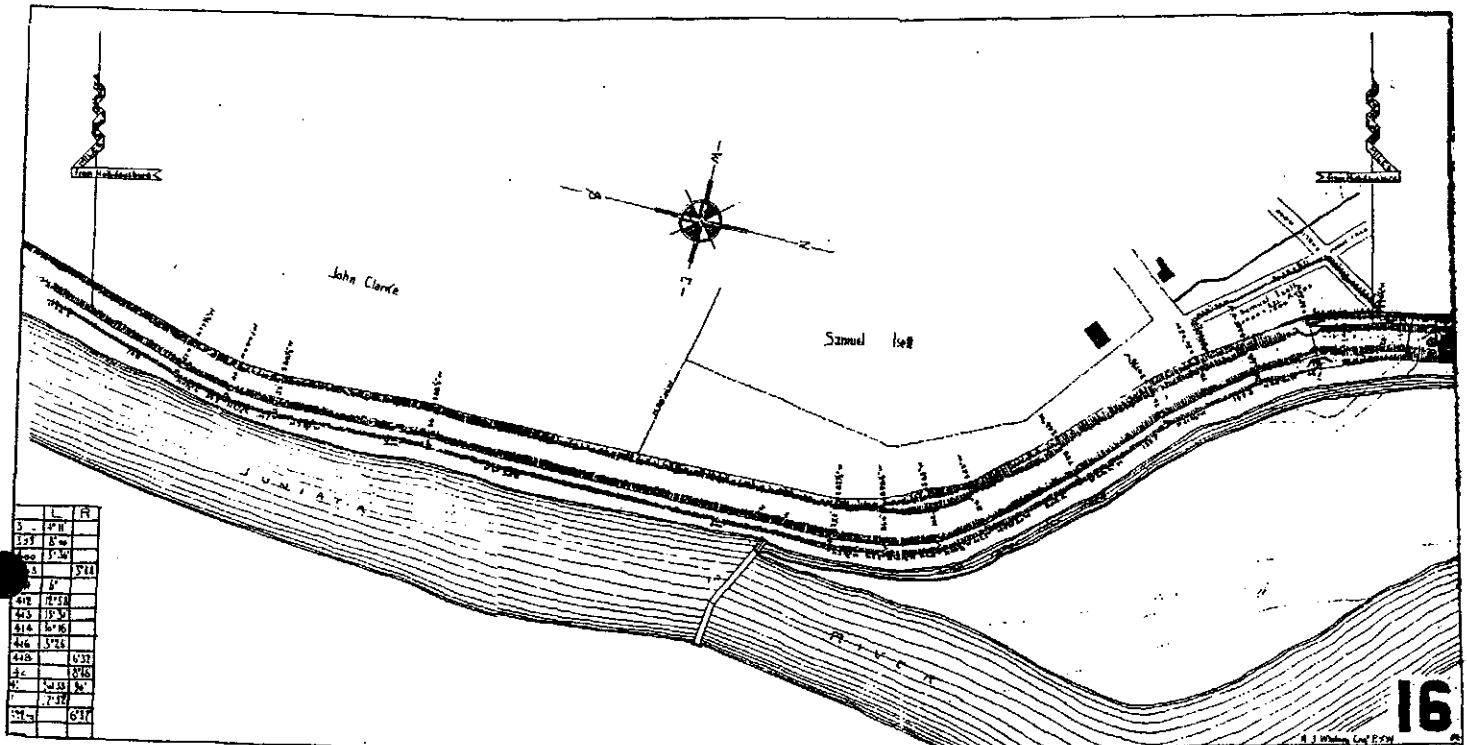
Pennsylvania Board of Canal Commissioners' Records: Map Book No. 2 b.
Juniata Division.



Pennsylvania Canal Guard Lock No. 6 at Sissler's.

Map of the Pennsylvania Canal: Upper Juniata Division, 1884. From the Out-lot Lock at head of Pool of Williamsburg Dam to Huntingdon in the Counties of Blair and Huntingdon. April 1 to October 1, 1884 by A.J. Whitney, Engineer, Right-of Way.

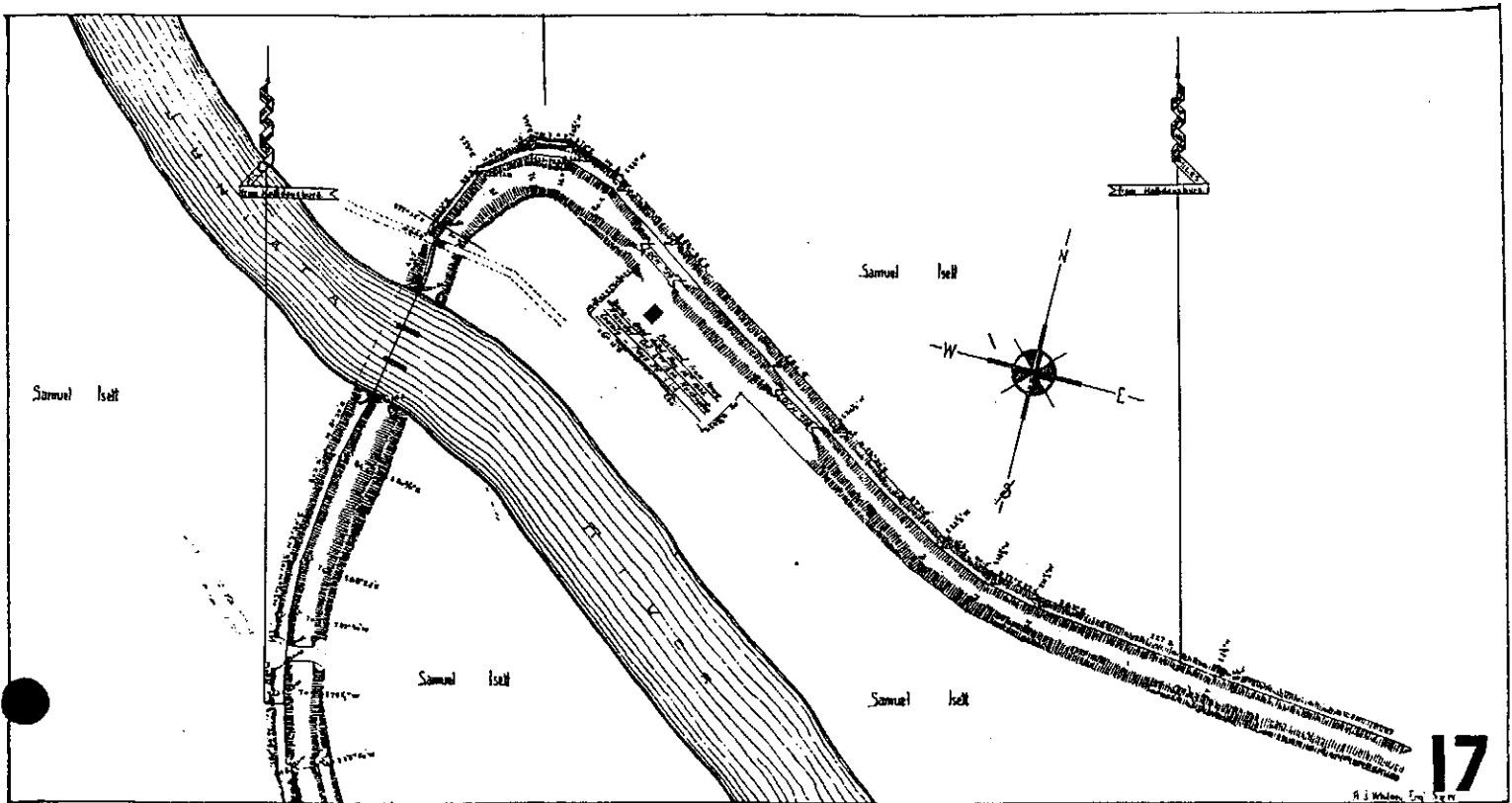
Archives of the Allegheny Portage Railroad.



Pennsylvania Canal through Samuel Isett's property.

Map of the Pennsylvania Canal: Upper Juniata Division, 1884. From the Out-lot Lock at head of Pool of Williamsburg Dam to Huntingdon in the Counties of Blair and Huntingdon. April 1 to October 1, 1884, by A.J. Whitney, Engineer, Right-of-Way.

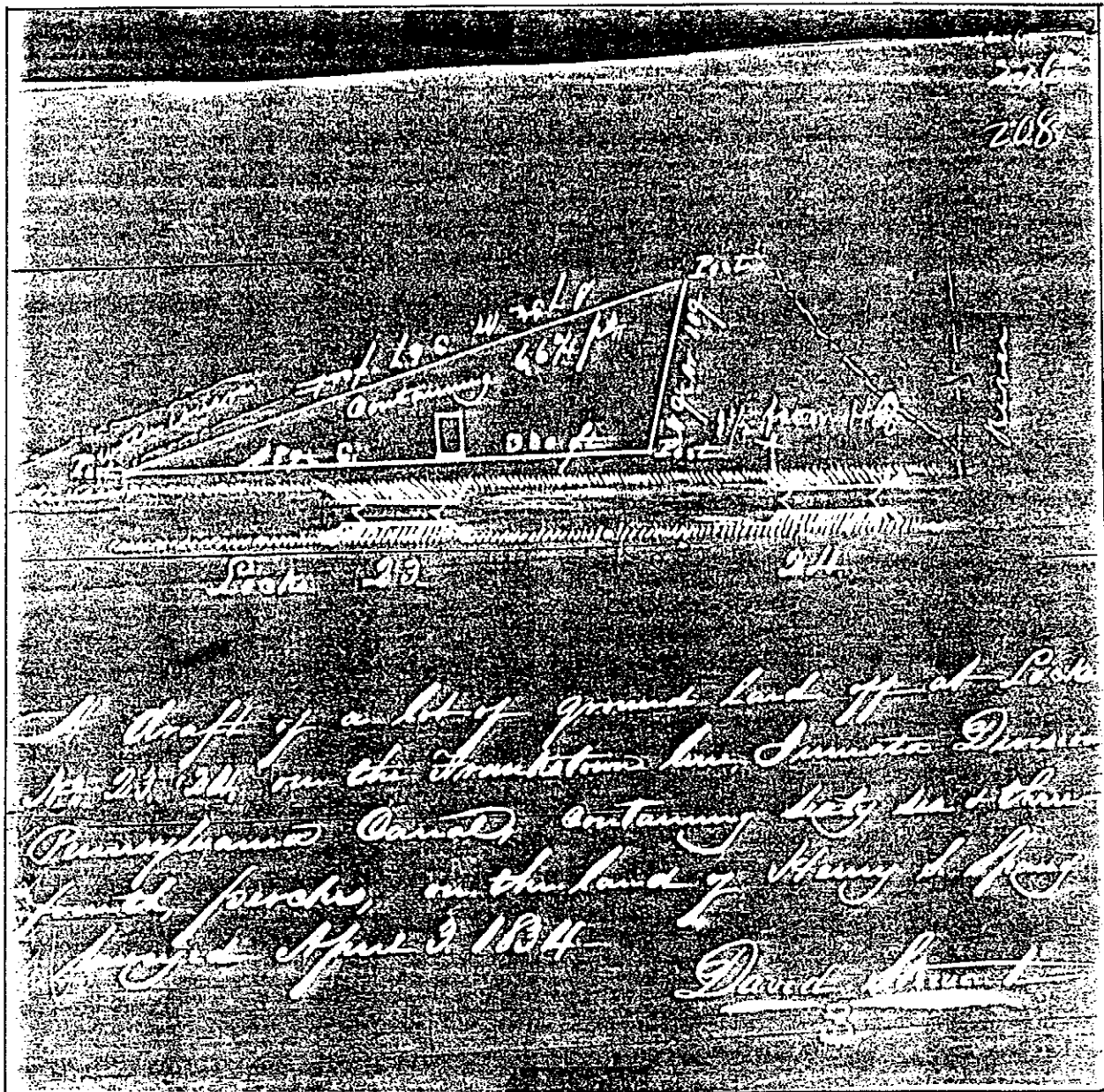
Archives of the Allegheny Portage Railroad.



Pennsylvania Canal across the Juniata River at Mt. Etna.

Map of the Pennsylvania Canal: Upper Juniata Division. From the Out-lot Lock at head of Pool of Williamsburg Dam to Huntingdon in the Counties of Blair and Huntingdon. April 1 to October 1 1884 by A.J. Whitney, Engineer, Right-of-Way.

Archives of the Allegheny Portage Railroad.



A Draft of Lock Nos. 23 and 24, including the waste weir. Surveyed on April 9, 1834.

Pennsylvania Canal Commissioners' Engineering Records, 1826-29.
Pennsylvania State Archives.

The construction of the Pennsylvania Canal was completed in the fall of 1832, immediately reducing the costly travel time between the Juniata region and both the eastern and western markets. Operation of the canal was plagued with persistent problems, however. Before the canal was constructed, Henry Spang and his fellow ironmasters' observed that certain parts of the Frankstown Branch contained insufficient water to supply the canal; their prediction proved to be correct.⁷⁸ Although the canal did provide a less costly form of transportation, damage from spring floods and winter ice resulted in expensive repairs and long periods of interrupted service. Only six years after the first packet passed by Mt. Etna, the Canal Engineer at Columbia complained that the canal had been "laid too low" and that "construction was imperfect particularly at locks and dams". Only one-half dozen years after the canal opened, twelve locks and two aqueducts had been rebuilt.

After recovering from the 1838 flood, a severe ice freshet during the winter of 1839-1840 again considerably damaged the works and prevented the spring opening until April 7, 1840. At that time, the Commissioners estimated the ensuing yearly cost of canal repairs at \$70,000 since "many of the locks are in bad condition, the lining decayed". By this time, eight of the uncovered aqueducts on the Juniata Division had been rebuilt.⁷⁹ In 1848, Spang's aqueduct was again rebuilt after only eight years of service.

Without a way to transport blooms and other iron products, production at the Juniata furnaces fluctuated with these unpredictable shut downs and delays. Not only was the canal prone to a continuous series of delays and repairs, but the system promoted corruption. As early as 1834, Pennsylvania legislators recognized the mismanagement that plagued the canal's operation. They investigated allegations of fraud, and two years later, the House of Representatives launched a major inquiry into the conduct of the Board of Canal Commissioners.⁸⁰

The Regional Iron Industry Prospers

After nearly a fifteen-year hiatus in iron furnace construction after the Panic of 1819, the opening years of the canal era saw the "blowing-in" of six new charcoal iron furnaces and 12 new charcoal forges in the western Juniata region. As the first boats passed through the Juniata Division of the Canal, Edward Bell built the Elizabeth Furnace north of Altoona and Peter Shoenberger placed the Sarah Furnace in blast. The Allegheny Furnace, out of blast since 1818, was rebuilt and began smelting iron again in 1836. In the same year, the Gaysport and Frankstown Furnaces, both located on the canal, were "blown in." Henry Spang, encouraged by the prosperity and innovative technology of the times, expanded Mt. Etna Iron Works to include the new Canoe Furnace located on the southern border of his properties and adjacent to the canal.⁸¹

After state surveyors determined the route for the Juniata Division, at least one new forge produced blooms nearly every year from 1826 to 1839. The new forges transformed the once isolated rural furnaces into more complex iron works. Bar iron and blooms sold and transported to the Pittsburgh rolling mills commanded much higher prices than pig iron, and regional ironmasters seized the opportunity to expand.⁸²

During the canal era, an important geographical shift in the iron industry occurred. The western ridge of Laurel Mountain in Fayette and Westmoreland Counties, from which the local iron industry evolved in its pioneer years, no longer dominated the industry. The number of new furnaces in both the south-central and northwestern regions in Pennsylvania dramatically increased. Along with the new Juniata furnaces, the northwestern counties of Clarion, Armstrong, Venango, Mercer and Lawrence established important iron

works.⁸³ This later region escalated production particularly after 1840 when sixty-five per cent of the new charcoal furnaces that went into blast were located in the northwestern counties.⁸⁴

It was during this period that both family-held businesses and partnerships began expanding their holdings to include several or more furnaces and forges, some associated with rolling mills in Pittsburgh. Henry Spang, Peter Shoenberger, and William Lyon were among those who rolled Juniata iron blooms at company-owned Pittsburgh mills. One of the earliest Juniata joint-stock companies was established by William Lyon in 1831 when he expanded his original partnership with Robert Stewart to the more advanced management system under Lyon, Foster and Company and finally Lyon, Shorb and Company. The company held some of the largest land holdings and works in the region including three forges, a slitting mill, a nailery, and three iron furnaces -- the Pennsylvania, Huntingdon and Bald Eagle Furnaces.⁸⁵ But, the leader of the Juniata iron region was Peter Shoenberger, who eventually controlled over 100,000 acres of land. Shoenberger became a millionaire several times over as he expanded his iron investments to include holdings as far as Ohio and Kentucky.⁸⁶ Although never achieving the phenomenal success of Shoenberger, Henry Spang continued to acquire additional ore tracts and rights, timber lands, and agricultural sites in Frankstown and Catharine Townships.

In 1828, the same year that the Pennsylvania Canal opened through the Pittsburgh area, H. S. Spang and Company established a rolling mill in an exceptionally advantageous location adjacent to the Pine Creek aqueduct of the Pennsylvania Canal. The Pittsburgh company consisted of an office on Water Street and the mill and warehouse located a few miles north of town on the Allegheny River at Etna.⁸⁷ By this time, at least two other Juniata Iron companies had already established rolling mills in Pittsburgh, including the Juniata Mill operated by George and J. H. Schoenberger, and the Sligo Rolling Mill, operated by Lyon, Shorb and Company.⁸⁸ Henry Spang's Pittsburgh rolling mill had a capacity of 1,500 tons and employed forty-five men. From September 1830 to September 1831, the mill rolled 860 tons of iron, 240 of which were made into nails.⁸⁹ While the elder Spang concentrated his efforts at Mt. Etna, his son Charles formed a partnership with James McAuley and Joseph Long in 1837 to manage the Pittsburgh mill.

Spang's Pittsburgh mill additionally fabricated products from blooms other than those made at his Mt. Etna Forge. A receipt book documents the arrival of iron blooms by canal boat to the rolling mill from 1839 - 1852. Only sixty-five per cent of the blooms shipped by canal in 1836 were fabricated at Spang's Mt. Etna forge. The remainder derived from other Juniata iron works including the Mary Ann, Elizabeth, Franklin, Barree, and Cove Forges.⁹⁰

Spang and Son's mill soon was recognized for its innovative technology and high quality products. Three years after the younger Spang took over the mill, the company pioneered in the manufacture of iron pipe to replace wood pipe, the first west of the Alleghenies.⁹¹ The new "boiling" process for producing wrought iron directly from pig iron was introduced in 1842.⁹² By 1849, Spang and Company was one of six Pittsburgh iron works that had converted to the production of steel,⁹³ and it was the first to utilize natural gas to manufacture iron.⁹⁴ In 1855, the mill fabricated 5000 tons of nails, bar iron and sheet principally from charcoal cold blast metal. However, some anthracite iron, blooms from the Juniata region and scrap iron were utilized in the production.

Canoe Furnace

As the Etna Iron Works prospered, Henry Spang constructed another furnace on the Pennsylvania Canal, the Canoe or Soapfat Furnace.⁹⁵ The new furnace was labeled the "Soapfat" Furnace when an order of bacon, shipped to the company store, was so rancid that workers reported it was unfit for consumption and good only for soap fat. The construction of this new furnace in 1837 was an expression of Spang's interest in new technology. The furnace utilized steam for power and was one of only several circular furnaces in Pennsylvania. By 1832, thirty-one per cent of the active iron works in Pennsylvania utilized either steampower exclusively or a combination of water and steam. Because there were fewer good waterpower sites in western Pennsylvania, steampower became increasingly more important here than it did in the east.⁹⁶ Both the Canoe and Etna furnaces had the same capacity of 1,400 tons, although Canoe produced 100 more tons per year than Mt. Etna furnace.⁹⁷

Above the furnace on Township Run, a race furnished water for Canoe's overshot wheel. A carriage house, stable, a large charcoal house, a blacksmith shop and a storeroom with basement and office stood behind the charging bench where the Point View Cottages are now located. A tram operated around the Short Mountain ore tracts to haul raw materials for the furnace. The stone manager's house overlooked the furnace from the hillside across Township Run near a spring. Other associated structures situated along the stream included a milk house, workers' tenements, the assistant manager's house and a schoolhouse/Sunday school. Near the blacksmith's shop was a double workers' house with a stone first floor and second story of log. Another large workers house was described as a "lower stone row consisting of apartments, and an upper stone row of five apartments, all a story-and-a-half high with open fireplaces in each." Located near the canal was a storehouse which also functioned as a boarding house. After only ten years of operation, Canoe furnace went out of blast in 1847, however, ore continued to be mined from the Short Mountain tracts. By 1859, no structures were extant in the area, and all the machinery associated with the furnace was removed in 1859.⁹⁸

The Mt. Etna Community

Unlike the industrial communities of the late nineteenth and early twentieth centuries when rural and urban environments were segregated, the harmony and interdependency of agriculture and industry remains an important theme throughout the charcoal iron era. This integration between agriculture and ironmaking is one of the distinguishing characteristics of the charcoal iron industry. Although some produce and crafts were obtained from local farmers, Mt. Etna incorporated large agricultural tracts of rich Juniata Valley limestone soils into the iron works complex. Ore miners and tenant farmers lived side by side on the valley tracts where iron ore outcropped adjacent to plowed fields and orchards. The company-owned grist mill ground grains for the community. In 1832, Spang estimated the agricultural products consumed by his establishment included 3,000 bushels of wheat, 8,000 bushels of rye and corn, 1,000 bushels of potatoes, 10,000 pounds of beef and 20,000 pounds of bacon.

By 1832, forty families lived at the Etna Iron Works and 150 workers were employed by Henry Spang. Spang owned between forty and fifty houses, roughly one dwelling per family. Even though the furnace operated only seasonally, year-round employment was available to laborers who worked from sunrise to sunset and were paid at an average rate of \$22 a month. Furnace relining and refurbishing, ore mining and woodcutting were winter tasks for laborers. Many Juniata furnaces operated throughout the year, although several went out of blast for a month or two during winter. The "blowing in" of the furnace

required nearly a week and much effort thus production ceased only when absolutely necessary. Most ironworkers spent the whole day at their jobs. Skilled workers - forgers, founders, and furnace hands - worked either a night or day turn and were paid by the ton. Forgers received \$7.00 per ton; wood choppers were paid forty cents per cord of wood.⁹⁹ The concept of the charcoal iron works as a self sufficient community can also be supported by Spang's statement that all the raw materials for the production of iron (iron ore, limestone, and charcoal) were available in the iron works complex; none were purchased.¹⁰⁰

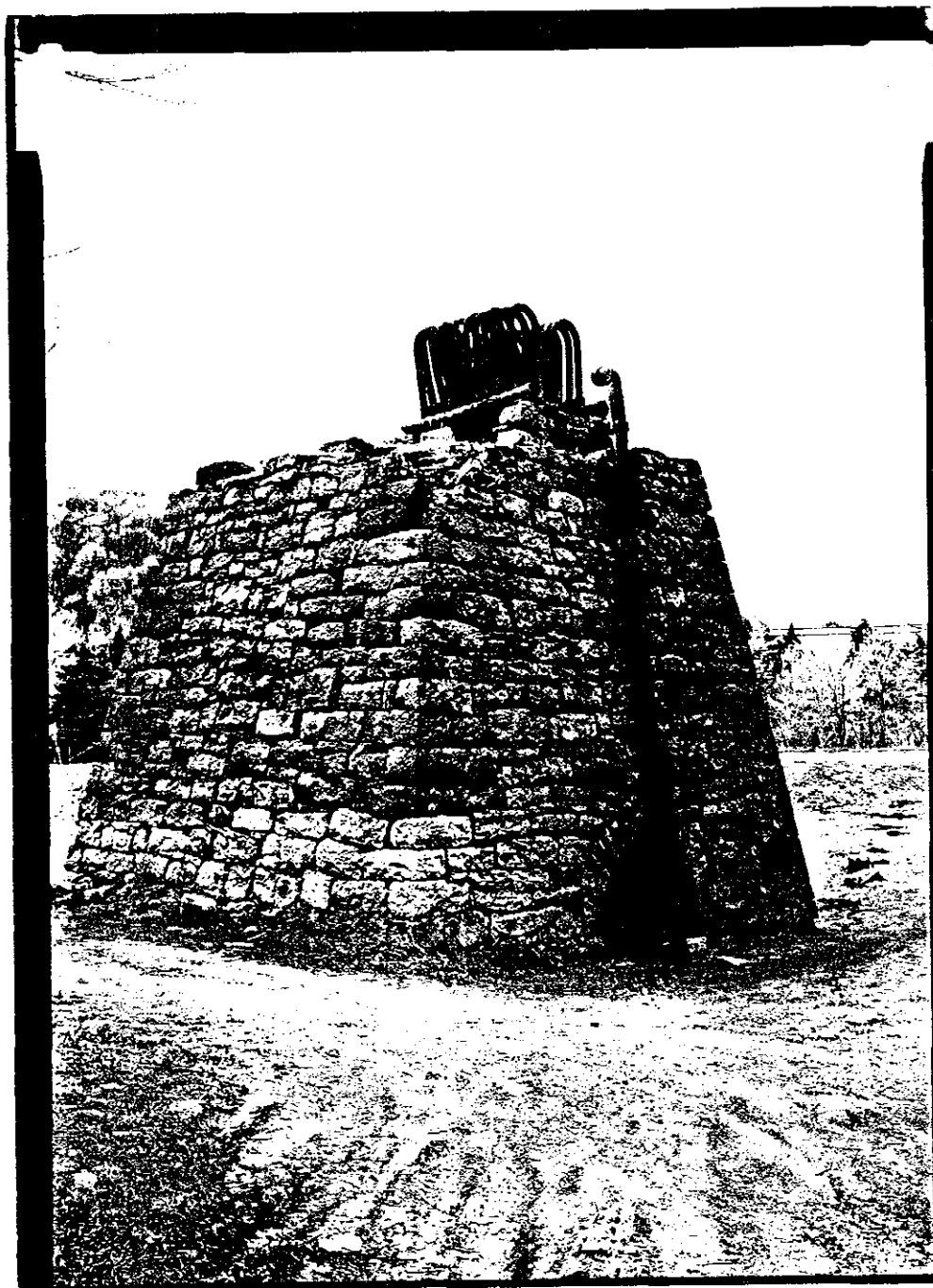
The extraordinary task of hand sawing thousands of cords of wood per year engaged the largest number of laborers at an iron works. The average cold-blast furnace used twenty-five cords of wood per day while the forge required an additional consumption of charcoal. A forge could use nearly 2500 cords of wood per year for a four-fire forge using patent blasts.¹⁰¹ The dry weather and low wind conditions required to make charcoal limited its production to late spring, summer and early fall. The collier was "obliged to haul the wood to the pit, pile it, and make his loads through the coaling ground to his team." After being brought from the bank, the charcoal was exposed for two days before being put in the coal house to guard against fire since many accidents occurred after charcoal was left in the wagons overnight. The coal was contained in "bodies" generally consisting of 200 to 250 bushels. Wood was purchased by the cord at a price of \$1.00 per cord with "permission to coal it on ground".¹⁰²

Introduction of the Hot Blast

One of the limiting factors in charcoal iron technology was the tremendous annual need for timber and by 1828, there was much concern about the scarcity of Pennsylvania's timber.¹⁰³ Any way to reduce the cost by more efficiently utilizing charcoal fuel meant increased profits and yield. The hot blast, patented in 1829 by Scottish ironmaker, James Beaumont Neilson, was a dramatic technological improvement for the international iron industry.¹⁰⁴ In 1829, Neilson developed the new method by using a simple rectangular stove with a heating chamber. The cold blast entered the chamber, was heated by a fireplace underneath, and passed out of the chamber into a tuyere. By raising the temperature of the air before it entered the furnace, fuel consumption was reduced. Because the cold blast method required the blast to be heated with charcoal thus using extra fuel, this new method proved to be very efficient and met the needs of many Pennsylvania ironmasters who saw their timber resources slowly depleting. Hot blast stoves became more common in anthracite furnaces while charcoal furnaces eventually employed the new heat exchangers. These devices were positioned on top of the furnace and attached to the tuyere by a manifold (see page 27).

The improved hot-blast technology increased furnace yield as much as 100 per cent.¹⁰⁵ On October, 1839, local newspapers described the success of G. Erkson at the Gaysport Furnace in Hollidaysburg who had converted his furnace to the hot blast method which "can be applied to furnaces, foundries and smith's fires" to produce more heat with less fuel.¹⁰⁶ Shortly afterwards, Henry Spang installed the necessary machinery and converted Mt. Etna furnace to the more efficient hot blast method.

Data relating to the precise alterations made to the furnace have not been recorded but the general furnace alterations can be suggested. Cold blast furnaces had smaller boshes and more commonly only one tuyere. When furnaces were converted, tuyeres were added and some furnaces rebuilt. When the hot blast was installed, the chimneys were often located on the covered charging bridge that was united with the top of the furnace stack near the tender's shack. In order for the furnace to operate year round, a frame wheel house covered the water wheel since freezing temperatures prevented the wheel from turning properly. At



View of Eliza Furnace, showing original cast-iron heat exchanger remains.
Located in Vintondale vicinity, Cambria County, Pennsylvania.

Photograph by Jet Lowe, April 1991. Historic American Engineering Record
collection, Library of Congress Prints and Photographs Division.

Mt. Etna, massive stone walls with three stone buttresses formed the cathedral-like charcoal house located east of the charging bridge. An improved ore crusher, consisting of a long line shaft and leather belt, was also located near furnace, as was an ore washer to cleanse the clay from Etna's brown hematite ores.

Not only did the new hot-blast technology reduce the fuel requirement, but it greatly increased production. It was not uncommon for a cold blast furnace to yield only 800 tons while the capacity of a hot blast system ranged from 1200 to 2215 tons. Only one eastern cold blast furnace, the Pennsylvania Furnace owned by Lyon, Shorb and Company, had a capacity of over 2000 tons.¹⁰⁷ In 1832, Spang's cold blast furnace at Etna had produced 600 tons of pig metal and 500 tons of blooms per year. After the conversion to hot blast, Etna furnace doubled its output to 1,200 tons per year.¹⁰⁸

Changes may also have been made in Mt. Etna's charcoal iron forge. The archival description of another Juniata Forge on Trough Creek, one which also ran three fires and one hammer, can be compared with Mt. Etna's operation. The Juniata Forge consumed 2500 cords of wood per year which were stored in an adjacent charcoal bed approximately 22' long, 4' wide and 4' high. By about 1850, "patent blasts" had been introduced to the Western Juniata forges and were placed in a shed on the exterior of the forge building.¹⁰⁹ Production at Etna forge had increased during the 1840's until 800 tons of blooms were fabricated annually.¹¹⁰

The presence of high heat and open fires in close proximity to the iron works' frame structures presented a considerable danger. The working spaces were extremely hot and the spread of fire a daily threat. A fire at the Allegheny Furnace near Altoona nearly destroyed the bellows house and fixtures. Although the furnace was saved, the damage was estimated at \$2,000.¹¹¹ Ladders were fixed to all sides of the Juniata Forge on Trough Creek to "enable the men to reach fire in any part of the building." The roof was covered with boards "said to be preferable to tile" to prevent fire.¹¹²

Products and Markets

In 1832, Spang annually produced 600 tons of pig metal at an average price of \$25 per ton and 500 tons of blooms at \$65 per ton. Within the next five years, he increased production to 900 tons of pig iron until he finally doubled the furnace's output by converting to hot-blast before 1842.¹¹³ Blooms were sent to the Etna rolling mill in Pittsburgh principally for the manufacturing of nails. The commodities produced at the rolling mill were dependent upon the market needs, and the products were either sold in Pittsburgh or shipped by land or water carriage to other western markets. The market "circle" extended to the "nearest cheap communication". According to Spang, there were no local markets for blooms and pig iron.¹¹⁴ Most iron works of western Huntingdon County (later Blair County) catered to the western markets reached by the canal, while many eastern Huntingdon County furnaces promoted their products in the other direction to the eastern seaports.¹¹⁵

Juniata iron products found ready markets in the western states of Ohio, Kentucky, Indiana. Agents from the major iron companies owned by Spang, Shoenberger, and Lyon, Shorb and Company probably established residences or visited many cities to promote their wares. Cash payments were sometimes received but credit could be extended for periods as long as one year. An exchange system in which products such as bacon, tobacco, muslin and sugar could be traded for nails, hardware, stoves, kitchen implements, and other iron commodities continued to function.

Along with pig iron and blooms, Etna ironworks fabricated 50 tons of castings per year including stoves.¹¹⁶ Skilled moulders produced waffle irons, clockweights, wagon boxes, and a variety of skillets and

kettles. Molds for these commodities were located near the furnace where molten iron was ladled into them. More than likely, the castings met the needs of local farmers and were sold at the company store.

An important economic component of the Juniata iron industry was the retailing of merchandise. All the local iron works applied for state licenses to operate their retail establishments. Iron plantation stores sold merchandise valued at an average of \$10,000 to \$15,000 per year, and dispensed several hundred dollars worth of patent medicines. The largest of these businesses was owned by William Lyon whose store sold between \$20,000 and \$30,000 worth of goods in 1849. Lyon was a partner in the joint stock company of Lyon, Shorb and Company.¹¹⁷

The company store at Mt. Etna opened at least as early as 1827 when Spang's principal occupation was listed as "storekeeper".¹¹⁸ The Mt. Etna store offered a diversity of wares included nails, stoves and other iron commodities as well as general merchandise, produce, crafts, and patent medicines. The services and goods provided by the grist and saw mills contributed additional income. Between 1846 and 1850, Henry Spang's son, Henry A., conducted the Mt. Etna retail business valued at \$10,000 to \$15,000. The company store sales at Mt. Etna was comparable to that of company stores at other iron plantations in the region.¹¹⁹

Instead of cash payments for wages, many iron companies disbursed paper store scrip or "pluck me's" to be exchanged at the company store (see page 30). The scrip was printed on thin rice paper sheets and often portrayed detailed vignettes of the iron works. Although the ironworkers' wages were comparatively high, the company store system controlled cash flow and generated additional profits for the ironmaster. When cash was scarce, scrip provided a means to continue operation without an outlay of gold and silver.¹²⁰

Mid-Nineteenth Century Decline of the Juniata Iron Industry

Three causes for the iron industry's volatility in the mid-nineteenth century include the cumulative effects of the crisis of 1837, the depression of 1839-43, and finally, the inconsistent tariff regulations culminating with the Tariff of 1846.¹²¹ Regardless of technological improvements and increased specialization in the Pennsylvania iron industry, the business had remained an unpredictable enterprise, one with inconsistent legislative support coupled with much foreign competition. English iron, particularly railroad iron, retained its reputation for quality and economy, regardless of claims by American ironmasters that their products could equal the imports on both counts. American ironworkers struggled to compete for this lucrative market just as they had for the nail manufactures earlier in the century. In 1839, one-third of the English imported iron went to the production of American railway iron.¹²²

On January 9, 1846, the Iron and Coal Association of the State of Pennsylvania met in Philadelphia to prepare a report on the status of Pennsylvania's iron and coal business and to address the effect of the industry on agriculture. The committee hoped to define, for the general public, the "magnitude and importance" of the industry as the "agents of a civilization and intellectual happiness that has no limits or bounds." But what the committee actually set out to accomplish was an organized effort focused on the critical tariff issue. Through group organization, they sought to describe the "dreary and desolate" effects of the Congressional failure to pass a compromise bill in 1842 to end the reduction of duties on foreign iron trade. By 1843, the price of American bar iron had plummeted from \$100 to \$75 per ton, and blooms from \$75 to \$38.¹²³

One of the major objections to the tariff was that all duties were paid on the ad valorem principle. According to this tariff form, the percentage paid was based on an article's cost in the country from which it was imported. Each importer estimated this cost, thus the duty was dependent on the individual importer's



Paper Store Scrip.

Ganis, G. Robert. "Iron-Making Store Scrip in Pennsylvania."

estimate, a system prone to fluctuation and corruption. Tariff critics suggested that European importers based their tariff estimates on the price of surplus goods rather than the prime market rate. Sugar and iron producers particularly suffered under this tariff form more than any other enterprises.¹²⁴ However, the Secretary of the Treasury believed that the profits of iron manufacturers were greater than any other national industry and therefore the tariff was warranted.¹²⁵

In the Juniata region, financial problems already existed. The sheriff seized Mill Creek Furnace and Barree Forge in 1844 and put both up for sale on January 8, 1845. The iron works property included all the "necessary machinery for blowing by steam or water, an excellent grist mill, first-rate sawmill, and a full complement of dwellings for the manage and hands to reside, all of which are nearly new and near the canal."¹²⁶

The year 1849 was especially disastrous for Pennsylvania's iron manufacturing business, with one-third of all Pennsylvania iron works failing or being sold.¹²⁷ Between 1849 and 1850, over half of the Huntingdon and Blair County furnaces either failed or were seized by the sheriff. Mt. Etna and Canoe Furnaces failed during the same year.¹²⁸

Just before the crisis, Henry S. Spang died at his residence at "Etna Forge" on March 6, 1845.¹²⁹ Since his wife had passed away in 1830, Spang willed the major part of the estate, including the Mt. Etna and Canoe Furnaces, to his son, Henry Alfred Spang. Five daughters divided \$21,000 in cash.¹³⁰ Before his death, the elder Spang had given son, Charles, the Etna Rolling Mill in Pittsburgh, which he successfully expanded to include twenty-five furnaces, four trains of rolls, and twenty-four nail machines.¹³¹ But son Henry A. Spang, was unable to sustain the family's Juniata iron business through the crisis and "contracted considerable debts since the decease of his father".¹³² The failure of the iron works touched the lives of these workers who were dependent on the iron works not only for their wages but for housing and supplies. These workers included thirteen forgemmen, eleven ore miners, four colliers, and four blacksmiths at Mt. Etna. In addition, the furnace manager, two furnace keepers, and four ironmasters lived in the Township.

After the failure of the Etna Iron Works and the death of his father, Spang entered into a partnership agreement with John Harnish, Peter Keller and Samuel Isett on July 6, 1849. Samuel Isett, who eventually gained control of all the Mt. Etna properties, was then an ironmaster from nearby Tyrone Township. The four men agreed to become co-partners for a period of six years from 1849 to 1855. The purpose of the partnership was specifically defined as "mining, making and refining iron, buying and selling of merchandise, and farming". The three new partners paid only \$1000 each to the firm, while Henry Spang granted all his real estate including the two furnaces, forge, grist mill, two saw mills and a number of homes, outhouses, barns and stables to the partnership. He retained only his kitchen and household furniture.¹³³

The new partnership lasted only seven months. On February 21, 1850, Spang sold an undivided three-quarters of the Etna Iron Works and Canoe Furnace lands with all the connected "ore rights, privileges and tracts" to Isett, Keller and Harnish for \$45,000. Spang reserved only fifty acres, part of two previously sold tracts, and several other minor exceptions.¹³⁴ By this time, Spang was experiencing financial disaster and, "owing to his misfortunes in business", was forced to transfer "all estate, real and personal and all his rights, credits, and expectancies whatsoever" for the sum of one dollar. Thomas Patterson of Williamsburg, the agent in trust for the creditors, took control of Spang's property.¹³⁵ The following year, Patterson sold Henry Spang's remaining interest in the Etna Iron Works to Isett, Keller and Harnish for only \$1500.¹³⁶

Isett Years: 1849-1877

Jacob Isett, a German shoemaker from Berks County, arrived in Huntingdon County in 1787 immediately following the American Revolution, just as the region was opening up for permanent settlement. Isett crafted shoes for workers at the local lead mines until 1795 when he purchased an excellent mill tract near Arch Springs in Sinking Valley.¹³⁷ The large grist and sawmills operated by Isett prospered and he became an important local merchant. The legacy of Jacob Isett's commercial success as a miller and store keeper was expressed through the excellent business background upon which his sons, Samuel and John, built their careers in the Juniata iron industry. Both Isett brothers initiated partnerships in Huntingdon and Blair County furnaces and forges early in their business careers.

The Isett family's first venture into the iron business came during the national depression following the War of 1812 when Juniata ironmaster, Edward Dorsey, lost his interest in the Barree Forge and mills in West Township, Huntingdon County.¹³⁸ This forge manufactured the Union Furnace's pig iron into blooms. Jacob Isett purchased this iron works, which included a furnace, sawmill, office, double log barn, coal house, blacksmith shop, smokehouse, and ten log houses in 1819 at a sheriff's sale.¹³⁹

Two important Juniata iron families allied in matrimony in 1825 when Jacob Isett's son, John S., married Mary Ann Bell.¹⁴⁰ Mary Ann Bell was the daughter of Edward Bell, a resourceful and imaginative local ironmaster, who patented the process by which steam was generated from the gas escaping from a furnace's tunnel head. He first utilized this new system at his Blair County ironworks, the Elizabeth Furnace, near Pinecroft.¹⁴¹ This ironworks remained in the Bell family, and from 1861 through 1864, Bell's grandson Edward Isett, was employed there as the ironmaster. The younger Isett eventually moved to Spruce Creek to continue managing the Isett family's merchant milling business there.¹⁴²

The Isetts continued to invest in charcoal iron forges near their family enclave in Sinking Valley. The adjacent Spruce Creek Valley area was particularly well known for good furnace and forge sites, and the brothers had the opportunity to observe the success and evolution of important regional iron works in their own backyard. In 1836, John S. Isett constructed the Stockdale Forge at Spruce Creek station. This small operation had two forge fires and a water-powered hammer.¹⁴³ Isett's interest in charcoal forges also included a partnership at the Water Street Forge from 1831 when it was constructed, until 1848 when the forge failed.¹⁴⁴

While his brother operated the Stockdale and Water Street Forges, Samuel Isett gained valuable experience in the iron industry by managing first the Elizabeth Forge and later the Cold Spring Forge. The Elizabeth forge consisted of a "number of log buildings for the hands, a two-story brick dwelling house, two stables, and a brick office" located one mile below the Coleraine Forges.¹⁴⁵ The Cold Spring forge consisted of the forge, a sawmill, a frame dwelling house and thirteen tenement houses.¹⁴⁶ In 1847, the Isett brothers joined with Samuel, Andrew and Richard Wigton in a partnership to manufacture iron at the Rockhill Furnace in Huntingdon County.¹⁴⁷ Two years after Samuel Isett bought into Rockhill Furnace, he acquired a one-fourth partnership in the Mt. Etna Iron Works from Henry Spang's son, who was experiencing financial difficulties.

By 1850, Rockhill Furnace had been seized by the sheriff and both Mt. Etna furnace and Canoe Furnaces had failed.¹⁴⁸ The Rock Hill partnership lasted from 1847 to the end of the Civil War. Even after the property was placed on the market by the sheriff, the Isetts and Wigtons managed to retain ownership. The decline of the Mt. Etna Iron Works during the next several years was reflected in requests to close two of the roads leading through the site. Local farmers, however, requested that the road between the Penn

Canal and the Etna storehouse be improved and retained because the route provided the only convenient place to load and unload canal boats. In the winter of 1854, the court-ordered improvements to this canal access road indicate that Mt. Etna was experiencing economic recovery.¹⁴⁹

Perhaps due to their business experience and knowledge of the risks involved with the iron industry, the Isetts diversified their holdings by combining agricultural and merchantile milling with iron production. This diversification may have been one of the key reasons why the Isetts had the ability--and ready cash--to remain solvent during the mid-century financial crises. When other regional ironmasters failed, the Isetts had the capital to buy their lands. In conjunction with his interest in charcoal forges, John S. Isett managed the Spruce Creek grist mill and several large farms. His political interests included an appointment in 1839 as the sequestrator of the Huntingdon, Cambria and Indiana Turnpike Company, a position he held for twenty-six years.¹⁵⁰ John's son, Edward B., also engaged in merchantilism, lumbering and agriculture in addition to iron manufacture. After the Civil War, he not only took over father's commercial enterprises at Spruce Creek, but continued the family's practice of land speculation by investing in timber tracts in Clearfield, Camhria and Jefferson Counties.¹⁵¹ Samuel Isett followed the same pattern by investing in lands with both industrial and agricultural resources.

During the next five years, Samuel Isett dramatically increased the value of Mt. Etna. He had gained control of another one-third share in the ironworks when John Harnish died in 1854 at the age of only thirty-six. Within this short period of time, Harnish's share was worth \$24,000, a phenomenal increase in his original investment of \$1,000 just five years before.¹⁵² In order to purchase the Harnish shares, Isett took out a \$12,000 mortgage.¹⁵³ Two years later, in 1856, Isett gained full control the iron works when Peter Keller relinquished his partnership and gave Isett a mortgage for \$18,000. It took Isett only four years to satisfy this loan.¹⁵⁴

Mt. Etna Ironworks prospered soon after Isett moved to Catharine Township and began supervision of the works. Now the domestical economy was expanding and by 1855, the American market consumed 1,310,000 tons of iron, an increase of 200 per cent in ten years.¹⁵⁵ Even so, Canoe furnace was never put back into blast after the tariff crisis of the mid-1840's. By 1859, the works were in ruin and all the machinery had been removed.¹⁵⁶ When Spang constructed this second furnace, the site's proximity to the Pennsylvania Canal was a critical factor. But, once Isett took control, plans for construction of an interstate railroad system were in place. Moreover, it may have been the phenomenal amount of timber and ore required to keep both furnaces in hlast that entered into Isett's decision to focus his ironmaking at Mt. Etna and to permanently abandon the Canoe works.

The Impact of New Technology in Railroads and Fuel

The Juniata iron industry rapidly evolved in the mid-nineteenth century in response to two major technological revolutions - the construction of a railroad linking Philadelphia and Pittsburgh, and the introduction of more efficient fuels to fire the iron furnaces. Within a few years after Isett purchased an interest in the Mt. Etna Iron Works, local ironmasters and iron companies considered the success of the new coke and anthracite hlast furnaces. Although the English experimented with coke instead of charcoal to fuel their iron furnaces as early as 1773, the American iron industry failed to accept the new technology until well into the nineteenth century. England had long suffered a lack of lumber, but, in America, large timber tracts were still available.

Transforming coal into coke involved a process of baking the coal in hot ovens to remove the sulphur and phosphorus found in soft coal. Upon haking, the coal fused into solid carbon masses which then

splintered as they are water cooled. A coke furnace operating in 1851 at the Great Western Iron Works in Armstrong County served as the harbinger of this new technology in western Pennsylvania.¹⁵⁷ The following year, Peter Shoenberger chartered the Cambria Iron Works in Johnstown and within four years, the facility had constructed four coke furnaces. The first furnaces at the new works used charcoal for fuel but within the first year of iron production, new coke furnaces were in the process of construction.¹⁵⁸ Coke furnaces were significantly larger than charcoal furnaces, and they required a high pressure blast in order to function. The Great Western coke furnace was 50' tall, had six tuyeres rather than two or three, and a bosh nearly twice the size of Mt. Etna. A characteristic low hearth also distinguished the coke furnace from the charcoal operations.¹⁵⁹

No new blast furnaces had been established in the Mt. Etna region for the seven-year period from 1846 to 1853 during the mid-century crisis. However, the interval between 1853 and 1857 saw the introduction of two new furnaces and the reconstruction of five older works for conversion to either coke or anthracite. That these new or refurbished furnaces were exclusively owned by companies, as opposed to individuals or partnerships, represents a significant change in management direction, one that would have far-reaching effects in industrial organization in the late nineteenth century. The gap between the family owned charcoal furnaces and the company owned iron businesses widened. At mid-century, more formal and complex forms of business organization including joint-stock companies and state-chartered corporations were replacing the traditional form of ownership either by individuals or a small number of partners.¹⁶⁰

The old hot-blast Huntingdon Furnace at Spruce Creek, was reconditioned by the Shoenbergers and went back into blast in 1857 for a short period. The pig iron produced here may have been sent to either the Cambria Iron Works in Johnstown or Shoenberger's Pittsburgh rolling mill, both under the control of the Shoenberger family. One of the largest cold blast furnaces in the region, the Bald Eagle Furnace (now known as the Olivia Furnace), was also renovated. Lyon, Shorb, and Company rebuilt the works in 1857 and installed a steam engine. In 1856, two older charcoal furnaces, the Frankstown and Gaysport Furnaces in Hollidaysburg, were rebuilt to use coke for fuel. In the same year, the Gardner and Osterloh Land Company built the Hollidaysburg Steam Hot-Blast Coke Furnace or Chimney Rock Furnace across the river from Gaysport. Chimney Rock, Frankstown, and Gaysport furnaces all used red fossil ore from mines near Frankstown and exclusively coke for fuel.¹⁶¹

Iron produced at the new coke furnaces was particularly well adapted for use in the rolling mills. With the iron industry seeking to wrest the railroad iron business from foreign competition, the method was especially attractive. In the case of central Pennsylvania, it was the iron companies and the partnerships with vested interests in rolling mills who pursued the railroad market through the introduction of new methods to reduce the cost of iron and to increase production. Coke and coal offered a solution to both problems. The high cost of the initial investment in construction or refurbishing, far outweighed the efficiency and expected cost reduction once the works were underway.

Juniata ironmasters were also introducing anthracite coal for fuel. In 1854, the Shoenbergers experimented with anthracite for the last blast at the Martha Furnace in McKees Gap. Three years later, Neff, Dean and Company constructed the Juniata Furnace in Williamsburg and exclusively used anthracite coal for fuel.¹⁶²

But, if the new fuels were so economical, why did charcoal iron technology persist for nearly a century after the new fuels were successfully introduced? Both the nation and local economies as well as general expectations of the iron industry's future patterned the individual owner's response to the new technology. Increasing the scale of production by investing in larger furnaces may not have been desirable

to smaller charcoal iron producers, and such major cash investments went beyond the financial capabilities of most. Perhaps, for many, the crisis over tariff regulations in the late 1840s and the subsequent failure of many iron works remained a most distressful subject. Along with the issues of financial investment and legislation, the proficiency of the new fuels became another factor. One of the limitations of coke furnaces was that some of the very high quality ores, once used to generate fine metals by the old charcoal iron method, failed to yield superior metals in the new furnaces. In general, iron smelted in coke furnaces was inferior to charcoal iron.

Several Pittsburgh rolling mills continued to use Juniata iron produced by the old cold blast method, now enhanced by steam. The Etna rolling mill, once owned by former Mt. Etna ironmaster Henry Spang, fabricated nails, bar iron and sheet iron principally from charcoal cold blast metal. However, some anthracite iron, Juniata blooms and scrap iron were utilized in the production. In 1852, once Mt. Etna was sold to Samuel Isett and partners, the rolling mill no longer used Mt. Etna's high quality blooms. In the spring and again in the fall of 1852, the Maria Forges sent seventeen shipments of blooms to Spang's rolling mill via the canal. Owned by J. H. Duncan, son-in-law of Peter Shoenberger, Maria forges were associated with the nearby cold blast furnace of Bloomfield. These were the only blooms received at Spang's on the canal during that year.¹⁶³ In addition to supplying blooms for Spang, these forges may have supplied the Shoenberger family's Juniata #2 Rolling Mill in Pittsburgh. The mill, established by Peter Shoenberger in 1826, operated with thirty-two furnaces. Lyon, Shorb and Company also continued to use a steam-enhanced cold blast method at their Bald Eagle and Pennsylvania Furnaces and to send blooms to the company-owned Sligo Rolling Mill in Pittsburgh.¹⁶⁴

During this period, another change in the Juniata Iron region was an increase in product specialization. Now the iron works produced either foundry iron, forge iron or a combination of both. Foundry iron was utilized for castings while forge iron was fabricated into bars or anconies. Specialized iron foundries now contributed to the Juniata iron industry by fabricating a variety of iron products, many for local consumption. The Rockdale Foundry, operated by William Kennedy at Williamshurg, made castings, stoves, plows, waffle irons and grates" and took "orders from any of the furnaces and forges". The foundries also supplied operative components for local forges and furnaces. "Water tuyere irons for furnaces" as well as hammers and anvils were produced by the Hollidayshurg Foundry owned by George McFarlane. "Castings of any weight and description and an assortment of plough castings, budgeons, sawmill castings, coal and wood stoves, grates, bollow ware, wagon boxes, and smoothing irons (were) always on hand."¹⁶⁵ The Gaysport Foundry which had been entirely destroyed on April 18, 1849 soon after it was constructed, was rebuilt and supplied similar products.¹⁶⁶

However, one of the most significant factors in the geographical and technological shifts in Juniata iron production was the introduction of the railroads. When the Pennsylvania Railroad was completed through the region in 1852, the new and refurbished iron furnaces were situated to take advantage of an improved and economical transportation system. The new Bennington Railroad construction stimulated at least one more furnace to be built in the western Juniata Region. An eastern company from Lowell, Massachusetts planned the furnace with "fixtures already on the way from the east." The iron ore on the Bennington Line "appears to be inexhaustible and of the best quality. No less than three veins were opened in grading the road, and seven different varieties are found adjacent to it ... the completion of the railroad and the construction of the furnaces will form an epoch in the history of Hollidaysburg, for they will undoubtedly lead to the erection of other works such as rolling mills, nail factories, etc. Eastern capitalists will then have demonstrated the superior advantage of our location for manufacturing purposes."¹⁶⁷

The railroad posed a formidable challenge to the canal, which maintained relatively high shipping costs. Many small state-chartered railroads had been operating throughout the state by 1844 and advocates for a state-wide rail system voiced increasingly stronger support. Town meetings were held in 1845 as part of feasibility studies for the construction of a railroad from Harrisburg to Pittsburgh via the Juniata and Blacklick valleys. The next year the Pennsylvania Railroad charter was approved and the first contracts for construction let.¹⁶⁸ The construction of the new Pennsylvania Railroad stimulated the iron industries of Hollidaysburg, Altoona, Tyrone, and Petersburg. But both the Pennsylvania Railroad and the Broad Top Railroad passed too far away to provide efficient service for Mt. Etna Iron Works.¹⁶⁹

Juniata ironmasters were aware of the difficulties and uncertainties of canal transportation. Their reluctance to expand production may well be related to an apprehension regarding the location of future railroads. If the canal was abandoned before rail service could take its place, adequate transportation would not be available. With no means to transport their pig and bar iron to market, local ironmasters could be faced with financial ruin.

In 1852, John S. Isett, brother of Samuel Isett and ironmaster at Spruce Creek, joined with other furnace men from both Hollidaysburg and Pittsburgh to protest the high canal tolls. "The Pennsylvania Railroad now offers to carry blooms from this station (Spruce Creek) to Pittsburgh for \$5 for 2000 which is less than we have been getting them carried from Water Street by the canal." A letter from Isett to E. Banks dated December 2, 1852, describes the problem which he believed would cause many local iron masters to "quit the business".

The iron masters in this neighborhood feel aggrieved at the tolls on the State Works on bloom and metal from our central position. We have to pay specific tolls which is (sic) nearly as much from here to Pittsburg as from here to Philadelphia as the maximum tolls are from Philadelphia to Pittsburgh or vice versa and the tolls on blooms are the same as the finished article of bar iron and nails when it is only an intermediate article between pig and bar iron and would more properly rate with the pig than bar iron. The anthracite iron shipped east of Duncan's Island pays less toll to Pittsburgh than metal shipped from here. Our intentions are to send a strong delegation to the canal commissioners when they are in session ...¹⁷⁰

Even though the Pennsylvania Canal continued to function in many areas now bypassed by the new railroad, the canal was clearly antiquated. The problems that plagued the canal -- corruption, continual and costly repairs, seasonally disrupted service, inefficient management and improved railroad technology -- were insurmountable. Promoters once believed that the canal would be a financial success and enough profits could be generated to educate every child in Pennsylvania. In 1856, the same year in which a continuous railroad line from Philadelphia to Pittsburgh was opened, the Pennsylvania Railroad Company purchased the Mainline Canal for \$7,500,000.¹⁷¹

The Civil War Era

Just prior to the Civil War, Pennsylvania remained the leading producer of pig iron with 125 furnaces in blast. But, the number of establishments was decreasing. In the ten years before the War, forty-three Pennsylvania furnaces had failed. In 1850, 404 furnaces in twenty-one states employed 21,054 persons including 207 females. By 1860, 118 furnaces no longer operated and over 5000 workers lost their jobs.¹⁷²

Even though the iron industry was radically changing, Mt. Etna experienced a major expansion during the two years prior to the Civil War. Isett doubled the number of mules from twenty-two to forty-two and purchased four new horses in 1859.¹⁷³

Shots were fired at Fort Sumter in 1861 opening the Civil War. Large quantities of iron were required for the war effort. Not only was military equipment such as guns, cannon, howitzers, and ironclad boats in great demand, but iron rails for miles of new railroad construction were critical to the war effort. The products fabricated at Mt. Etna during the Civil War have not been recorded but the census indicates that a moulder and three casters were employed during the war, suggesting that cannons may have been cast. In the western Juniata District, only one new iron furnace, the Rodman Furnace at Roaring Springs, went into blast during the opening years of the war. The iron produced there was cast into the famous Rodman guns.¹⁷⁴

Even with many workers off to battle, the Blair County charcoal furnaces produced iron as never before. During the opening years of the War, the iron industry dominated the County. Of the 1,030 county workers, by far the largest number of employees, 400 males, worked at the 11 iron furnaces. Six foundries and seven forges also produced iron products in Blair County. Three-quarters of the county workers were associated with either the production of pig iron, blooms, nails and castings or were blacksmiths. Over a million dollars representing nearly per cent of the total capital invested in manufacturing, financed the iron industry.¹⁷⁵

After the Civil War ended, the iron industry continued to prosper as the process of reconstruction and railroad building prolonged the high demand for iron products. Blooms from Mt. Etna's forge were used for boiler plate, steel, and general purposes.¹⁷⁶ Soon after the war was over, Samuel Isett retired as Mt. Etna's ironmaster but the works remained within the family. Isett's son, George D., took over the "manufacturing of pig iron and blooms".¹⁷⁷ On May 2, 1864, Isett relinquished all his rights to Rock Hill Furnace with two exceptions. The Isett brothers retained the ore rights to the Cunningham ore bank and received permission to build another furnace near the old Edward Furnace. However, several months later, the brothers sold all interest in the Rock Hill Furnace to Bernard Lorenz and Levi G. Leamer.¹⁷⁸

Fourteen other iron furnaces continued to operate in Blair County but, by 1872, only four maintained the now antiquated charcoal method of production. Furnaces still owned by the leaders of the Western Juniata charcoal industry (Isett, Royer, and Lyon, Shorb and Company) produced the high quality blooms and pig iron for which they were so well known.¹⁷⁹

The Industrial Community of Mt. Etna

In 1858, just before the opening of the Civil War, only eighteen per cent of the families in Catharine Township owned the properties upon which they resided. Property owners were, for the most part, farmers who were taxed for their dwellings, associated barns and "good limestone lands". Frequently, farmers resided on properties near the Turnpike or on other major township roads. Several farmers combined their agricultural pursuits with other occupations including justice of the peace, doctor or ironmaster. Two ironmasters lived in the Catharine Township, Isett and John Royer. Owner of Springfield Furnace and Cove Forge, Royer owned in a frame house across the river from his forge. Samuel Isett owned "houses, barns, stables, good limestone land and state land" at Mt. Etna.

Laborers comprised half of the township residents, but only one laborer, Thomas Shade, owned any property. His small house, shop, and limestone farmlands were situated east of Short Mountain near Isett's

ore bank. Skilled workers including blacksmiths, forgers, colliers, millers, merchants and shoemakers lived in rental properties as did some laborers.¹⁸⁰ The ironmaster either rented his company-owned houses to the employees or offered them as a perquisite. Such benefits were common at the iron works. For example, at Cove Forge, forgers and other hands were furnished with "a dwelling-house, one half acre of ground and free access to the fruit orchards, with other privileges, which makes laborer's wages (\$.90 and \$1.00) equivalent to \$1.15 to \$1.25, others in proportion."¹⁸¹

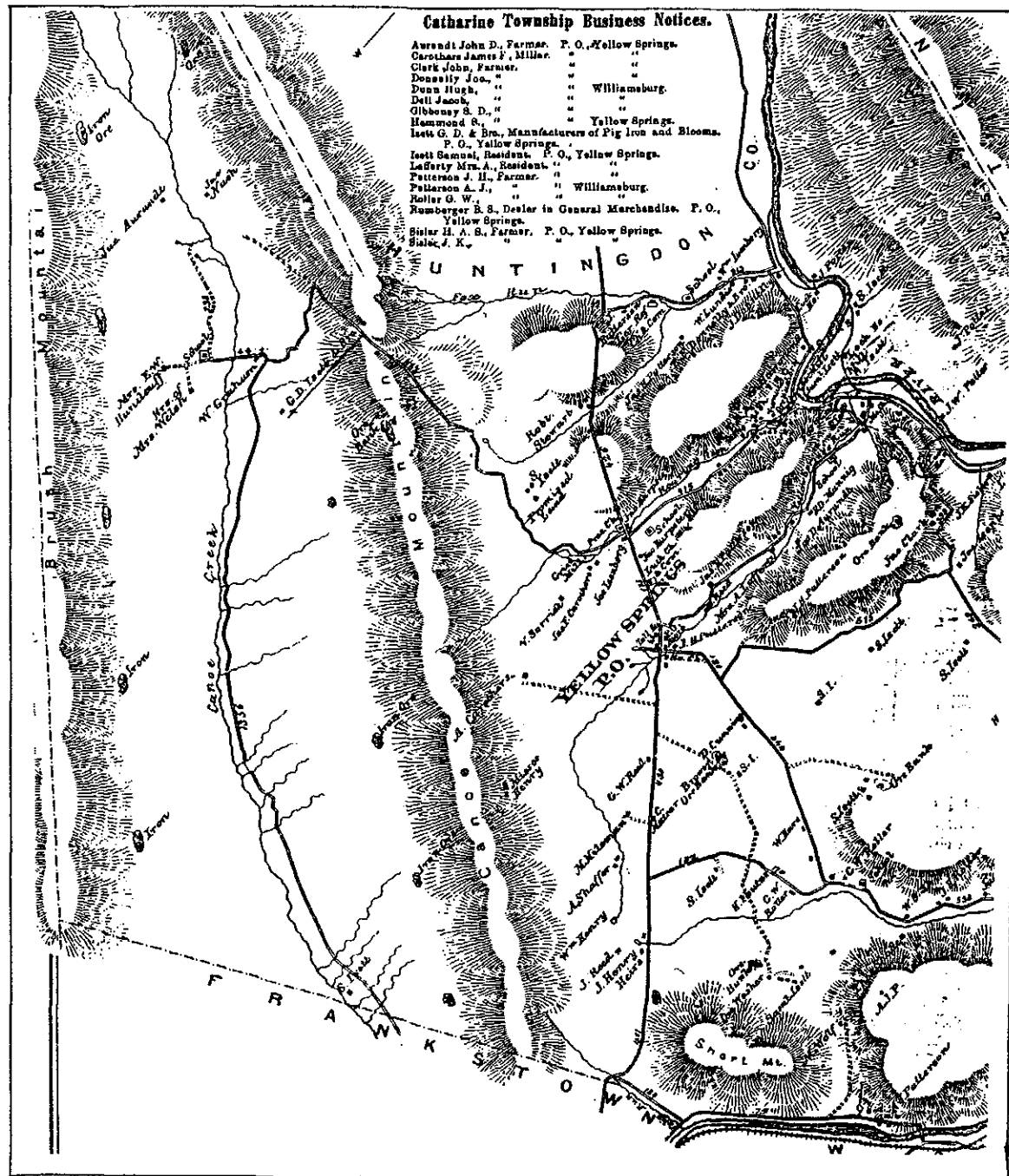
Nearly a quarter of the township inhabitants were single men who were attracted to the region by jobs available at Mt. Etna Iron Works or Cove Forge. Single workers owned no property and either lived in "shantees" along the river, boarded with other families, or resided in the Mt. Etna hostel. Several ironworkers also boarded at Maxwell Kinhead's inn at Yellow Springs. Here at the small crossroads village, Kinhead, a longterm township resident, housed boarders and conducted business at his store. A Turnpike tollhouse stood across the road near the deep, clear spring that had attracted travelers to the village for many years.¹⁸² For ironworkers, however, the mile-long walk to Yellow Springs, after an exhausting twelve-hour shift, made the inn a much less desirable housing selection.

During the Civil War period, the pattern of workers' housing at Mt. Etna conformed to a different system than that described for housing at other iron plantations. The villages at Curtin and Hopewell clustered near the core area. At Mt. Etna, one linear group of structures was situated along the Juniata River near the ironmaster's house. Skilled workers including the master fitter, caster, blacksmith, the furnace keeper, and founder resided here along the canal and river. At one end, the forgers occupied five loghouses across the street from the forge. Other groups of workers lived near the store, furnace, and mills. Small housing groups, consisting two to five structures, assembled near a variety of raw material sites -- ore banks, timber and agricultural tracts.¹⁸³ At base of Canoe Mountain near the Canoe timber and ore tracts, a group of residences formed the small village known as The Promised Land. In 1860, families of laborers, teamsters and a collier, Daniel Lower, resided in this area. According to the 1873 Atlas, there were 4 houses, one owned by a Mrs. Rankin who lived with her daughter, son and the son's family (see page 39).¹⁸⁴

Local informant, Elvin Saylor of Williamsburg documented one example of the cluster housing at Mt. Etna. Saylor, whose family purchased land from Isett, has a photograph of one of three houses located near a surface ore mine at the edge of his farmland. The two-story log dwelling had double front doors on the facade and a small front porch. According to Mr. Saylor, one additional log house and a frame house were also present in this cluster.

Mt Etna's workers still "owed their soul to the company stores." Isett had much experience in retailing both with his father at Arch Springs and later at the Rock Hill Furnce store. By 1851, he and his partners applied for two retail licenses, one at the furnace and one at the mill. The Mt. Etna store continued to sell a variety of necessities including patent medicines.¹⁸⁵ Unlike many other prominent men in the iron business, Isett's name never appeared as a supporter for any tavern licenses. In fact, Isett and his partners pushed for the removal of two lock keepers who were selling liquor to their ironworkers. In 1852, Isett wrote:

A subject that is of great importance to us - namely allowing lock tenders to sell spiritious liquors. We have two lock tenders immediately in the neighborhood of our works who profit very much by selling liquor to our men. We have made complaints to the late supervisor for the past two years, M. Anderson, who promised to stop it and told us that he had given them to understand if they offended again they would be discharged. It had



1873 Atlas of Blair County, Catharine Township.

1873 Atlas of Blair and Huntingdon Counties, Pennsylvania.

the effect to make them a little more careful for a time but ... (they) were back in even the one that annoys us the most is located on our property immediately below our works. He says he has been there and will continue to sell while he stays. His name is Westbrook. What we wish you to do is to require the supervisor appointed for the Juniata Division to replace this man and put one in his place that will not annoy us.¹⁸⁶

Before the Civil War, rural ironworkers may have received higher salaries than those working in the complex Cambria Iron Works during its early years of production. At Cove Forge, the highest paid workers in 1857 included the run-out man at \$3.00 per day, the forge manager at \$2.50 and the six forgemmen who earned \$2.10 a day.¹⁸⁷ At Cambria Iron Works, only three furnace workers had a daily wage of over \$2.00, the founder at \$3.00 and two engineers at \$2.00.¹⁸⁸ It is interesting to observe the substantial drop in wages at the rural ironworks in the 1870's. The highest wage at Mt. Etna in 1874 was \$1.75 for clerks and bosses.¹⁸⁹

Few immigrant laborers worked at Mt. Etna Iron Works, and only one category of workers, ore miners, contained a high percentage of foreign-born persons. Of the eighteen miners listed in 1850, only four were born in the United States. Immigrants miners included eleven Irishmen, two Welshmen, and one German. Ore miners or raisers received a low income, one equivalent to the laborers. Only the "master miner", William Marshall who resided near Williamsburg and may have been associated with Cove Forge, warranted an increased salary.

The high percentage of immigrant miners contrasts with other job groups related to the furnace. In 1850, only two of the thirteen forgemmen were foreign-born workers and two of the four colliers were immigrants. All of those listed as iron masters, lock tenders and blacksmiths were born in the United States. However, Josiah Ben, a German, held the highly skilled position of furnace keeper. The number of immigrants decreased until 1860, when only one employee, an English forgemman, was foreign-born. After the Civil War, four foreign ore miners arrived to work at the Mt. Etna mines. This traditional rural charcoal iron works thus employed second and third generation American workers, and the new immigrants now arriving in the United States, found employment elsewhere.

The number of immigrants employed at Mt. Etna Iron Works and in fact, living in Catharine Township as a whole, gradually decreased from 1850 to 1870. The ethnic mix in the township was surprisingly homogenous, and consisted principally of citizens born in Pennsylvania. In 1850, they comprised 88.6 per cent of the population and increased in number to 98.1 per cent by 1870. The number of foreign-born residents decreased from only nine per cent of the population in 1850 to 3.3 per cent in 1870. The only ethnic groups represented were Irish, German, and English.

As the foreign-born population decreased, the number of domestic servants nearly doubled, from twelve in 1860 to twenty-two in 1870. There is little evidence to indicate that women performed any industrial tasks at Etna. Because many of the duties performed by females included part-time work such as cutting wood, mining or seasonal farming, these jobs were probably not listed by the census takers. Only one woman, a worker at a carriage company, was engaged in manufacturing during the Civil War era. Women also supplemented their husband's income by performing such tasks as sewing, and caring for boarders. Boarders lived with many township families associated with Mt. Etna.

Blacks appear to have played little, if any, part in Etna's operations. David Stewart, one of the original partners, owned a slave, however, he probably worked as a servant rather than at the iron works.

After a peak in 1820 of eleven blacks in Catharine township, the number declined to nine in 1830, six in 1840 and three in 1850. No African Americans appeared in either the 1860 or 1870 Catharine Township records. The three blacks working at Mt. Etna in 1850 boarded at the local inns. Joshua Fitzua, a laborer, lived at the inn at Yellow Springs; Allison Alexander, who had no occupation listed, boarded with Mary Rankin in the Promised Land; and James Logan, also a laborer, lived at Donnelly's Inn, near Samuel Isett.¹⁹⁰

Although Catharine Township farmers remained in the region for many years and their descendants can be traced for at least several generations, only a few Mt. Etna's employees were related to earlier furnace workers. Even though most employees were born in Pennsylvania, the workforce was transient. Few workers could be traced through more than a few years residence. John Hinkle, Etna's founder between 1860 and 1862, had one of the highest paying occupations at the iron works. Forgemen Christopher Zeek, laborers Hy Reddy and Jonathon Benner, and James Leeper, a caster, appear both on the 1860 census and continue to reside at Mt. Etna for at least another 4 or 5 years. In addition, Joseph B. Gifford managed Etna for Samuel Isett from 1850 until 1861, when George D. Isett, Samuel's son, moved from his position as company clerk to become manager.

Through the 1870's, Mt. Etna Iron Works continued to employ 75 persons, about half of the original team working for Spang in the early 1830's. The skilled labor force included ten forgemen, ten furnacemen, three blacksmiths, nine teamsters, four "bosses, clerks etc.", a miller, and a carpenter. The furnace no longer smelted iron all year long and furnacemen worked only eight months a year while forgemmen had annual employment for nine months. Daily wages ranged from only \$1.75 for clerks and bosses, \$1.50 for forgemmen and \$1.15 for furnacemen.¹⁹¹ Following the Civil War, the increased salaries offered to skilled workers at large urban iron works attracted many workers. However, the urban environment could be dangerous; many new "foreigners" lived there; and there was little contact between management and workers. Regardless of their less than competitive wages, many rural ironworkers seemed to be satisfied with their situation. One county ironmaster, John Royer, believed that the cooperation of management and labor was the key to his success.

We have never experienced any strikes or troubles with employees in settlement of their accounts or otherwise. Employees have always lived peacefully and with due respect to their employer ... I would add, without hesitancy, that this unusual feature is solely attributed to a sober, intelligent and industrious lot of men engaged. We have men who were here as long as forty years, and others raised here. The majority are church-going people, and all opposed to intemperance, and the consequences is that such hands have always earned money, and today some of them own good farms and others from \$2,000 to \$5,000, all accomplished by industry and good management.¹⁹²

Schools and Churches

The brick German Reformed Church and graveyard (now Keller's Chapel) was located north of Mt. Etna, and the Lutheran Church and cemetery were situated on the old Turnpike. Just before the Civil War, the plank frame Methodist Episcopal Church, constructed next to Isett's mansion was built in 1860.¹⁹³ Isett and his family continued to attend the Sinking Valley Church near the family homestead in Arch Springs where their family burial plots were located.

Workers also used a small unmarked cemetery located on the ridge behind the tenant house, as a burial site. Over a dozen burials, principally children, were marked with inscribed stones. Two of the individuals, Howard I. Ross (d. 11 Jan 1839) and Margaret Chilcot (d. 15 Oct. 1851) appear to be children of laborers. George L. Alexander (d. 25 Nov 1853) was the blacksmith's son and Edmond Leeper (d. June 1858 or 59), the son of a caster.¹⁹⁴ The decipherable dates range from 1832 through 1859 and occur before the erection of the Methodist Church near Isett's house. A local legend that a small pox epidemic preceded most of the burial does not appear to be grounded in fact. The deaths occurred over a wide span of time, with only one reference to small pox, a twenty-eight-year old male, actually inscribed on a tombstone.

There were two schoolhouses at Mt. Etna, one on Roaring Run and the other situated near the ironmaster's house on Yellow Springs Run. As soon as Isett took over Mt. Etna in 1850, a road between the top of Canoe Mountain and the public schoolhouse at Walter Graham's on Roaring Run was constructed.¹⁹⁵ Perhaps the mountain families of teamsters, colliers, and laborers attended school at Roaring Run while the Isett family and the skilled workers living along the Canal attended school near the ironmaster's house on Yellow Springs Run.

Agriculture

Both agriculture and the associated commercial milling contributed an important economic element at Mt. Etna. Tenant farmers living on Isett's land provided the essential agricultural crops for consumption by both workers and animals. At nearby Cove Forge employed four farmers and a miller who were paid \$350 to \$375 per year "with the usual privileges of men taking charge of farms."¹⁹⁶ These privileges most likely consisted of a dwelling house and personal use of some lands. Even at a complex iron works like Cambria in Johnstown, 1,000 acres of land were cleared for great crops of wheat, corn and hay after the works was founded in 1852.¹⁹⁷ At Mt. Etna, Isett owned five large farms, at least three of which had associated houses and bank barns.¹⁹⁸ Two other farms owned by Isett were noted on the 1873 Atlas. In 1874, George D. Isett remarked, "This company (Mt. Etna Iron Works) is also engaged in farming, which employs considerable of the time mentioned. Proceeds of farming consumed principally by employees."¹⁹⁹

The End of Mt. Etna's Charcoal Iron Industry

For nearly a quarter of a century following the establishment of complex iron works such as the Cambria Iron Company in Johnstown, the Juniata charcoal furnaces continued to function. Even after new technology was introduced, charcoal iron furnaces and forges continued to fabricate high quality pig iron and blooms. Charcoal furnaces competed with much larger operations, most of them fueled with coke, and owned by large joint stock companies. Four of the Blair County furnaces - Bennington, Frankstown, Gaysport and Hollidaysburg - had been purchased by the Blair Iron and Coal Company. This joint stock company had general offices in Philadelphia but also operated a steel plant in Pittsburgh, the Blair Iron and Steel Company. Iron sponge and open hearth stoves were fabricated there until October, 1875 when the plant was closed.²⁰⁰ However, the company's four Blair County furnaces, supervised by W. R. Babcock, continued to produce "Bessemer metal" using both local Pennsylvania ores and raw material shipped by rail from the Lake Superior region.²⁰¹

Rates of production for anthracite and coke furnaces far exceeded output at the old charcoal furnaces. In 1874, Mt. Etna manufactured 1,008 tons of pig iron while the combined tonnage for the two coke furnaces at Hollidaysburg during that year was 11,088.²⁰² Two years later, values for the coke furnaces ranged from \$92,420 to \$148,720 while Isett appraised Mt. Etna's worth at only \$40,000. By this time, only the old Mt.

Etna and Springfield Furnaces continued to utilize charcoal to fuel their furnaces; Rodman Furnaces in Roaring Springs had gone out of blast and their mines were nearly at standstill.²⁰³

In 1878, the Tyrone Forges complex, owned by the Pittsburgh-based Lyon, Shorb and Company, produced its last blooms. This long-lived Juniata Iron company ended when Andrew Carnegie's Edgar Thomson works leased Lyon, Shorb's Pennsylvania Furnace. The Carnegie concern drafted plans to rebuild the furnace for coke and to erect two boarding houses to accommodate some of the projected 700 men to be employed there by 1880. Plans to rebuild Huntingdon Furnace and to develop the "fine ore banks of Lyon, Shorb and Company" were also suggested.²⁰⁴

In regions that were still without rail service, the Pennsylvania Railroad continued to maintain segments of the old Pennsylvania Canal. Parts of the Juniata Division remained opened nearly a quarter of a century after other divisions had closed. To many Juniata iron masters, the canal was the sole means of transporting their products. In 1874, the canal at Mt. Etna was finally abandoned. A new railroad spur to provide Mt. Etna and other nearby towns with transportation was still years away from construction. As the canal was abandoned, George Hatfield of the Juniata Company in Alexandria reported: "The abandonment of the Pennsylvania Canal in September, 1874, cutting off our transportation and we are compelled to work up our stock and cease operations." His thirteen laborers, two forgemasters and two puddlers lost their jobs.²⁰⁵

The Catharine Township tax collector crossed off both Mt. Etna's furnace and forge in 1876. At that time, the grist mill was valued at \$2,500 while the furnace was worth only \$1,000 and the forge \$600. By 1879, the forge was probably torn down since no value was listed on the 1880 taxes. In the same year that Mt. Etna's forge ceased production, Isett sold seven of his horses, and the following year he reduced the number of mules from twenty-five to just four.²⁰⁶

One of the first bloomery forges to be built in region, Cove Forge, remained the last in operation, continuing to utilize Springfield Furnace charcoal pig iron through 1880. By 1878-9, however, John Royer reported that tonnage had been cut in half and profits reduced by over seventy-five per cent, from \$75,000 to \$17,000. Royer's Springfield Furnace produced the last charcoal iron in Blair County.²⁰⁷ Just as the Isett and Spang families, the Royers had arrived in Blair County with experience in the iron industry gained from employment in eastern Pennsylvania. Royer noted that "circumstances gained from employment in eastern Pennsylvania."²⁰⁸ Royer noted that "circumstances after the beginning of our civil war were such that the manufacturer of iron as a branch of industry was completely revived, and continued until 1872, when good iron was not wanted to any extent, parties substituting inferior grades of iron, for merchants' and other manufacture."²⁰⁹

However, the demand for high quality charcoal iron continued in some specialty industries that manufactured mechanical components such as railroad wheels and brakes. In addition, some of the earliest Bessemer steel plants preferred charcoal pig iron to that made from coke. Sophisticated improvements in the production of charcoal included first the distilling of charcoal in "beehive" kilns ca. 1850, and then a more advanced retort system designed by engineers in the late nineteenth century. Timber for charcoal stood as far as 100 miles from some of the iron furnaces and was shipped by rail.²¹⁰ It was in 1919, forty years after the last Juniata charcoal furnaces ceased, that the peak year of American charcoal production was reached. The last blast furnace to make charcoal pig iron closed operations in 1945.²¹¹

Around 1874, a year that saw the last blooms hammered at Mt. Etna's forge, Samuel Isett authorized rights-of-way for both telegraph lines and oil pipes to traverse his lands. Permission for both new rights-of-way was negotiated by Herman Haupt, famous for his skill in rapidly supplying railroad lines and bridges

during the Civil War. Since the oil pipes passed along the old Pennsylvania Canal, Isett made certain that he retained the option to grant a future railroad right-of-way.²¹² These new communication links now connected Mt. Etna to the outside world.

By the early 1880's, Mt. Etna was in ruins. "Decay and dilapidation greet the passer-by ... Many dwellings are tenantless, the store and gristmill alone being in operation" and Catharine Township had lost nearly one-third of its population. The decade between 1870 and 1880 saw this major demographic shift with a decline from 907 to 579 persons.²¹³ In the winter of 1884, Isett sold the Old Canoe Furnace lands, but still reserved the mineral rights and a right-of-way for several more years.²¹⁴ On the old industrial properties, the Point View Cottage Association began building summer homes.

But the decline lasted only a short time. Developers examined and recognized Mt. Etna's rich natural resources of timber, gannister and limestone and looked to exploit them again. By the early 1890's, the Juniata Limestone Company began a series of important limestone quarries in the Mt. Etna and Carlisle area. By this period, the Petersburg Branch of the Pennsylvania Railroad now passed along the old Pennsylvania Canal right-of-way. Stimulated by the new industry, tenement houses formed a small company town, and industrial buildings were constructed near Carlisle.²¹⁵ In response to the new economic activity, the Isett Post Office, with Samuel Isett serving as the first postmaster, was established in 1893 at Mt. Etna.²¹⁶

At least one of the old Mt. Etna ore mines continued in operation. In 1880, Isett maintained the Short Mountain Mine for both the Charlotte Furnace Company and the Rock Hill Iron Company. In 1890, Isett gave Edward R. Isett a \$6,000 mortgage for a 102-acre ore bank. The younger Isett mined the raw material under the name of the "Aetna Mining Company".²¹⁷ By this time, Samuel and Mary Ann Isett were no longer able to administrate the Mt. Etna properties. The couple gave power of attorney to John Lafferty and their two sons, Harry and George D. Isett on August 8, 1890. The three men controlled all the old Mt. Etna tracts with the exception of the Sissler Farm located south of Mt. Etna near the Juniata River. The elder Isetts also maintained control of a 202-acre land tract and their town residence in Altoona.²¹⁸

Samuel Isett died on May 18, 1895.²¹⁹ To his wife, Mary Ann, he bequeathed his homestead consisting of a house, garden, and stable as well as a half interest in the Sissler Farm. The remainder of his estate was equally divided among the eight Isett children. The estate inventory lacks any indication of the complex iron works once under his control. Instead his possessions included those of a farmer and part-time blacksmith. Isett's sons, Harry and George, purchased the "Homestead Farm" in Catharine Township for \$5,000 which consisted of a 243-acre tract including the ironmaster's stone house on the bank of the Juniata, "six tenement houses, a blacksmith shop, store and a building with weight scales." Other relatives, including Claire Bloomhardt, eventually purchased much of the Mt. Etna's land.

In 1907, over half of Isett's Canoe Mountain timber tracts were found to be rich in the gannister used for refractory bricks and Harbison-Walker Refractories negotiated for their purchase. In 1916, the Canoe Mountain tracts were again lumbered, this time by the McKelvey Brothers Company of Blair County. By now, it had been nearly fifty years since Mt. Etna's charcoal furnace and forge ceased production, and the timber on Canoe Mountain incorporated good second-growth stands. The McNitt-Huyett Lumber Company of Centre County first purchased several of the Canoe Creek tracts, including the Harbison-Walker lands, which they later sold to the McElvry Brothers. The company built a circular sawmill and several workers houses in the Canoe Creek Valley where a Pennsylvania Railroad spur already served a nearby quarry. Two boarding houses, one on the Creek and one on the Mountain, housed workers as well. The McElvrys

operated a fourteen-mile narrow gauge logging railroad across the summit of Canoe Mountain to Yellow Springs. A movable tie sawmill advanced as the logging progressed. Pilings and utility poles of red and white oak timber were cut by the McKelveys until logging ceased in 1926.²²⁰

Current Status of Mt. Etna Iron Works

Today, the two major land tracts which compose the nucleus of Mt. Etna Iron Works have been placed on the real estate market. The seven parcels in the Detwiler tract include the ironmaster's house, log houses, and canal hostel. The stone bank barn, tenant house, blacksmith shop, store/office, original ironmaster's house, and the charcoal house are within a five-parcel property owned by the the Casselberry family. In 1961, the Blair County Historical County acquired the Mt. Etna iron furnace and a one-foot right-of-way around the exterior of the furnace. In an attempt to preserve this historic structure, the Society repaired the stonework with mortar and emplaced a cement cap over the top of the stack. Unfortunately, this cap caused a freeze/thaw action which resulted in the collapse of the facade.

On June 15, 1961, the Blair County Historical Society proposed that the Pennsylvania Historic and Museum Commission acquire Mt. Etna Iron Works for the purpose of preservation and tourism. Four years later, Mt. Etna was slated for an appropriation of Project 70 funds to be used for site development. Dr. S. K. Stevens, then executive director of the Commission stated: "This (Mt. Etna site) is probably the best remaining example of an early iron-making community surviving in the state in terms of the number and variety of the buildings. The canal that remains nearby adds greatly to the potential of the spot as an historical area worthy of consideration."

Cost estimates for the purchase of nine Mt. Etna tracts were reviewed by the Blair County Commissioners in February 19, 1970. The following week, the Blair County Tourist Bureau received permission to contact owners about acquisition of the Mt. Etna tracts. The Bureau considered two options, 1) the use of matching Project 70 grants for the land purchase and 2) the purchase of the lands by Blair County. If the later option was selected, the county would present a bill to the state legislature thereby allowing the county to give the properties to the Pennsylvania Historic and Museum Commission. During this year, however, the Commission was negotiating to fund the Curtin Village Project near Bellefonte and by May 22, had agreed to support the Curtin reconstruction instead of Mt. Etna. County commissioners failed to meet the Project 70 deadline in June thus county acquisition of the site was considered "not active" at that time.

In May of 1972, the Pennsylvania Register of Historic Sites and Landmarks prepared a National Register Form for "Etna Furnace". Although the nomination included all the extant structures in the complex, there are discrepancies in the map, geographical coordinates, property ownership, and descriptive material. In 1976, "Etna Furnace and Forge" was also included by Historical American Engineering Record (HAER) Inventory.

Faith Mummert (now Detwiler) bought the Detwiler tract on August 28, 1970. Ten years later, Mrs. Detwiler and her husband conspired to burn the ironmaster's house. Over \$100,000 in damages resulted when the blaze engulfed the center of the structure. In 1986, Mrs. Faith Detwiler was convicted of arson and finally in 1988, she pleaded guilty and was fined \$500 and sentenced to seven days in jail and 300 hours of community service.²²¹

The old Mt. Etna timber tracts on Canoe Mountain, traditionally known as the "Beaver Dams", have now been included in Pennsylvania State Game Lands No. 166. When the Game Commission purchased the

property, the sites of many charcoal-making operations were noted. This game lands resource encompasses 6,039 acres in two separate tracts. Over one-third of the lands are considered to be poor tracts for timber products due to the steep terrain and inferior reproductive sites. This Game Lands, more heavily utilized than any other in Blair County, is popular today for turkey and deer hunting.²²

ENDNOTES

1. This quote, from Thomas J. Chapman, History of the Valley of the Conemaugh (Altoona; 1865), 157, described the blast furnace operations of the Cambria Iron Company in Johnstown. Though a much smaller operation, Etna Furnace likely evoked a similar feeling among workers and residents at Mt. Etna.
2. Huntingdon County Deed Book: D-1: 447.
3. The Bedford site continued to be an important locality for the production of iron. Three furnaces were eventually built near there including the Rockhill Furnace operated by Samuel and John Isett. See "Early Iron Enterprises in Pennsylvania," in U.S. Census, Tenth, vol. 2, Manufacturers (Washington; 1883), 81-84.
4. Tench Coxe, A Statement of the Arts and Manufactures of the United States of America for the Year 1810 (Philadelphia; 1814) xxxi-xxxii.
5. Convention of Iron Masters, Documents Relating to the Manufacture of Iron, Published on Behalf of the Convention of Iron Masters which Met in Philadelphia on the 20th of December 1849 (Philadelphia; 1850), 30.
6. Coxe, A Statement of the Arts, 49-51.
7. Huntingdon County Deed Book: B:394.
8. U.S. 1798 Tax List, Morris Township, Huntingdon County, Pennsylvania.
9. Huntingdon County Tax List, 1801.
10. "Map of Cambria Iron Works Properties," Johnstown Flood Museum Archives, 1919. Canan applied for two warrants to nearly a thousand acres of rich ore lands later used by the Springfield Furnace.
11. J. Simpson Africa, History of Huntingdon and Blair Counties, Pennsylvania (Philadelphia; 1883), 425.
12. Huntingdon County Deed Book: B-1: 76-78.
13. Huntingdon County Deed Book: F-1: 556.
14. Blair Historical Society, p. 32, 35.
15. Pennsylvania State Game Commission, State Game Lands No. 166, Blair County.
16. Commonwealth of Pennsylvania, Annual Report of the Secretary Department of Internal Affairs, Bureau of Industrial Statistics, Official Documents, 1894 (Harrisburg; 1895).

17. Ibid, p. 153. Arthur Cecil Bining, Pennsylvania Iron Manufacture in the Eighteenth Century (Pennsylvania Historical and Museum Commission; 1938), p. 28.
18. Huntingdon County Continuance Docket E:354, February 18, 1806.
19. Huntingdon County Deed Book N-1:224.
20. Bining, pp. 71-2.
21. Weitzman, Traces of the Past, p. 154.
22. "Manufacture of Pig Iron", Department of Internal Affairs, 1895, p. 24 D.
23. Jon D. Inners, "Mt. Etna Iron Furnace Plantation, Blair County," Pennsylvania Geology, 1986.
24. "Documents Relating to the Colonial History of the State of Pennsylvania." Journal of the Franklin Institute, 3d series, #21, 1851, tables following pp. 69-72.
25. Anonymous, n.d. Untitled manuscript "Juniata Forge/Mary Ann Furnace". State Archives of Pennsylvania, Record Group MG2.
26. "Mary Ann Furnace" manuscript.
27. Sternagle, Alton M., Iron Furnaces of Blair and Huntingdon Counties, IN: 51st Annual Field Conference of Pennsylvania Geologists: Selected Geology of Bedford and Huntingdon Counties, Pennsylvania Geological Survey and Juniata College, 1986. p. 20.
28. Huntingdon County Tax Lists, 1809-1813.
29. Paskoff, Paul F. Industrial Evolution: Organization, Structure and Growth of the Pennsylvania Iron Industry, 1750-1860, Johns Hopkins University Press, Baltimore and London. 1983, p. 48.
30. Bureau of Industrial Statistics, Official Documents, 1894, p. 32.
31. Wallace, Paul. Indian Paths of Pennsylvania. Harrisburg: Pennsylvania Historical and Museum Commission, 1971, 50.
32. Buck, Solon J. and Elizabeth H. Buck. The Planting of Civilization in Western Pennsylvania. University of Pittsburgh Press, 1939, p. 234.
33. Blair Historical Society p. 34-35.
34. Breck, Samuel. Sketch of the Internal Improvements Already Made by Pennsylvania. J. Maxwell, Philadelphia. 1818.

35. Harshbarger, Jean P., Taylor, Nancy R. and Zabriskie, Sara H., Hartslog Heritage. State College: K-B Offset Printing, Inc., 1975, p. 107.
36. Reiser, p. 93.
37. Reiser, Catherine E., Pittsburgh's Commercial Development, 1800-1850., Harrisburg: Pennsylvania Historical and Museum Commission, 1951 p. 137.
38. Bining, pp. 53-54.
39. Huntingdon County Quarter Sessions E:260.
40. Huntingdon County Deed Book R-1:226.
41. Huntingdon County Tax List 1811.
42. Huntingdon County Sheriff's Deed Book 116:85.
43. Hazard, Samuel, Register of Pennsylvania, October, 1831. p. 276.
44. Tyrone Forge was constructed in 1804 by Lyon, Shorb and Company, and the following year they constructed Coleraine Forge. Lephlar, Kraetzer (Crotzer) and Co. built the Spruce Creek Forge in 1798. The Juniata Forge was owned by Shoenberger, and the Barree Forge by Dorsey and Green.
45. Huntingdon County Tax List 1814.
46. Huntingdon Sheriff's Deed Book 82:541.
47. Pennsylvania State Game Commission, Abstract of Title, Vol. 258, Item 60.
48. Ibid, Item 41.
49. Blair Historical Society, p.38.
50. Jordan, John W. Pennsylvania Encyclopedia of Biography, pp.1884-1886; Bining, Arthur Cecil, Pennsylvania Iron Manufacture in the Eighteenth Century. Pennsylvania Historical and Museum Commission, pp. 171-176; Lesley, J. P., The Iron Manufacturer's Guide to the Furnaces, Forges and Rolling Mills of the United States, John Wiley, Publisher, 1859, pp. 56-61.
51. Huntingdon County Deed Book S-1:142.
52. One example is the purchase of ore rights to a 14-acre tract on the south side of Yellow Springs Run. Huntingdon County Deed Book V-1:85. Fisher's death was recorded in Huntingdon County Deed Book V-1:15-88.
53. Huntingdon County Deed Book V-1:85.
54. Huntingdon County Tax Lists 1823-1828.

55. Hazard, Samuel, ed. The Register of Pennsylvania. Devoted to the Preservation of Facts and Documents, and every Kind of useful Information Respecting the State of Pennsylvania. Philadelphia: William F. Geddes, March, 1828. p. 169.
56. Hazard, Samuel. The Register of Pennsylvania. Jan. 1828. p. 42.
57. Lesley, The Iron Manufacturer's Guide; "Documents Relating to the Colonial History of the State of Pennsylvania." Journal of the Franklin Institute, 3d series, #21, 1851, tables following pp. 69-72.
58. (Tax Lists 1822).
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60. McLane, Louis. Documents Relative to the Manufacturers of the United States. Vol. 2, 1833. Reprinted 1969, New York: Augustus Kelly, 1969, p. 331.
61. U.S. Census 1820 and 1830.
62. Huntingdon County Tax Lists, 1832.
63. McLane Report, vol. 2, Doc. 14, #59.
64. Huntingdon County Quarter Sessions G:332.
65. Blair County Deed Book B:378.
66. Huntingdon Tax Lists 1808-1845; Blair Tax Lists 1847-1877.
67. McLane Report, Vol. 2, doc. 14, No. 59.67.
68. Pennsylvania Board of Canal Commissioners' Records with Allied Records of Canal Companies Chartered by the Commonwealth. State Archives of Pennsylvania, Record Group RG-17. Reports and Miscellaneous Documents, Box 11, Letter dated March 20, 1840.
69. McLane Report Vol. 2, Doc. 14, No. 59.69.
70. Etna Centennial Committee, Centennial of the Borough of Etna, 1869-1969, Etna: Etna Centennial Committee, 1969.
71. Pennsylvania Board of Canal Commissioners Records: Field Notes of the Survey and Level of the Juniata in Fall of 1824.
72. Pennsylvania Canal Commissioners. Message from the Governor Accompanied by a Report of the Canal Commissioners and Accompanying Documents. Harrisburg: Boas and Caplan, 1838-1840.
73. Pennsylvania Board of Canal Commissioners' Records, Reports and Miscellaneous Documents, Box 10.

74. Pennsylvania Board of Canal Commissioners' Records, Reports and Miscellaneous Documents, Box 10.
75. Pennsylvania Board of Canal Commissioners' Records Reports and Miscellaneous Documents, Box 10, Letter dated May 18, 1831 from Edward Gay to the Board of Canal Commissioners. Near Sissler's farm was Guard and Lift Lock # 19 which was connected to Dam #8, a 200' long and 16' high span. The canal continued on the north side of the river for 1 mile and 10 chains to Aqueduct #3, a 20' span over the head race to Spang's Forge, thence 10 chains to Aqueduct #5 (incorrect citation by Gay, this is Aqueduct #4) across the river. The aqueduct consisted of 3 spans of 60' and connected the north bank with a point called the Yellow Bank. Here, the prism required cutting of 9' in depth for 3 chains then made a bearing suddenly to the right, it extends 34 chains to Lock #24 at the head of Pool #9. From the foot of Lock #24, the towing path crosses the river by towpath bridge # 5 and continued to the north side to Dam # 9.
76. Pennsylvania Board of Canal Commissioners' Records Juniata Division Contracts. Vol. 7:100. The contract for Spang and McMaster included the following services:
- For stone work, per perch of 25 cubic feet, \$3.50
 - For carpenter work, \$24 per foot of lineal measure
 - For excavation, \$.24 per cubic yard
 - For excavation of solid rock, \$.50 per cubic yard
 - For puddling, \$.25
 - Embankment, \$.15.
77. Harshbarger, Taylor, and Zabriskie. Hartslog Heritage.
78. Pennsylvania Board of Canal Commissioners' Records, Reports and Miscellaneous Documents, Box 10.
79. Ibid p. 22.
80. Wallner, Peter A., Politics and Public Works: A Study of the Pennsylvania Canal System, 1825-1857. A Thesis in History, Pennsylvania State University, 1973. 174-5.
81. Lesley, The Iron Manufacturer's Guide; Sharp and Thomas, A Guide to Old Stone Blast Furnaces; Harris, Isaac, Harris' Directory of Pittsburgh and Vicinity, 1837, pp. 266-68; Journal of the Franklin Institute, 3d series, #21, 1851, tables following pp. 69-72.
82. Ibid.
83. Sharp and Thomas, A Guide to Old Stone Blast Furnaces in Western Pennsylvania. Figure before introduction.
84. Chamber, Thomas, Eckert, G. N., Reeves, Samuel J. (Committee), A Report of a Committee to the Iron and Coal Association of the State of Pennsylvania. Jasper Harding, Printer, Philadelphia, 1846 pp. 11-12.
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117. Hollidaysburg Register and Blair County Inquirer, May 31, 1849; May 1, 1850.
118. Huntingdon County Tax Lists, 1827.
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120. Ganis, G. Robert. "Iron-Mining Store Scrip in Pennsylvania." Pennsylvania Geology. Vol. 19, No. 3. July, 1988. pp. 2-5.
121. See Paskoff, Industrial Evolution, p. 85.
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123. Ibid, pp. 3-5, 5-16.
124. Hollidaysburg Gazette and Blair County Inquirer June 5, 1850, June 12, 1850.
125. Chamber, Eckert, and Reeves, A Report of a Committee to the Iron and Coal Association of the State of Pennsylvania, p. 20.

126. Hollidaysburg Register and Huntingdon County Inquirer, Jan. 8, 1845. The sale also included a large Mansion House purchased from J. and J. Milliken; many tracts of land; a limestone quarry with a two-story house and barn; the forge with another sawmill, gristmill and weather-boarded mansion.
127. Paskoff, Industrial Evolution p. 82.
128. Journal of the Franklin Institute, tables following pp. 69-72. The hot-blast furnaces that were sold included the Elizabeth #2 at Frankstown, the Gap Furnace in East Freedom, Monroe at Pine Grove, Mill Creek, Union, Winchester, Rockhill and Chester at Orbisonia.
- Paskoff, Industrial Evolution, p. 85. Although Etna, as well as many other iron works in the Juniata region, supplied principally western markets and were associated with Pittsburgh rolling mills, both Blair and Huntingdon Counties were included as part of the eastern region. In this region, 55% (n=33) of the cold-blast charcoal furnaces and 53.7% (n=36) of the hot-blast furnaces were out of blast in 1849.
129. Huntingdon Journal, March 19, 1845.
130. Blair County Will Book 4:417, 419.
131. Lesley, The Iron Manufacturer's Guide, p. 251.
132. Blair County Deed Book B:219; U.S. Census, 1850.
133. Blair County Deed Book B:219.
134. Blair County Deed Book B:378.
135. Blair County Deed Book B:418.
136. Blair County Deed Book C:323.
137. Huntingdon County Deed Book D-1:447.
138. Huntingdon Sheriff's Sales Docket:85:554.
139. Huntingdon Sheriff's Sales Docket 82:541. Dorsey and Green soon regained control of Barree Forge according to Hazard, Samuel. The Register of Pennsylvania. Jan. 1828.
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142. Jordan, History of the Juniata Valley, p.1097; Africa, Sampson J., History of Huntingdon and Blair Counties, Pennsylvania, Philadelphia: L.H. Everts, 1883, p. 277.
143. Harris, Isaac, Harris' Directory of Pittsburgh and Vicinity, 1828-1837; Lesley, The Iron Manufacturers Guide. James Garden leased and managed the forge for Isett in 1859.

144. Journal of the Franklin Institute, tables following pp. 69-72.
145. Huntingdon Sheriff's Deed Book p. 263:1472.
146. Lesley, Iron Manufacturers Guide; Blair County Deed Book D:97.
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149. Blair County Quarter Sessions A:260.
150. Africa. p.277.
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153. Blair Mortgage Book A:241.
154. Blair Mortgage Book B:82.
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161. Lesley, 1859.
162. Lesley, The Iron Manufacturer's Guide to the Furnaces, Forges and Rolling Mills of the United States, p. 60.
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168. Stephenson, Clarence D., The Pennsylvania Canal: Indiana and Westmoreland Counties, A.G. Halldin Publishing Company, Indiana, Pa., 1979, p. 35.
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171. Stephenson, The Pennsylvania Canal: Indiana and Westmoreland Counties p.36.
172. Census of 1860 Book 3 p. 498 and p. clxxxv-i.
173. Blair County Tax Records, 1859.
174. Zentmyer, R. A., Early Iron Works of Central Pennsylvania, The Altoona Tribune, Altoona, 1916.
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176. American Iron and Steel Association, Directory to the Iron and Steel Works of the United States, Philadelphia, 1878, p. 36, 153.
177. Atlas of Blair and Huntingdon Counties, Pennsylvania, from Actual Surveys by and Under the Direction of Beach Nichols. Published by A. Pomeroy & Co., Philadelphia; U. S. Census 1870, State of Pennsylvania.
178. Huntingdon Deed Book R-2:82.
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180. Blair County Tax Lists, 1859.
181. Commonwealth of Pennsylvania, Annual Report of the Secretary. Department of Internal Affairs, Bureau of Industrial Statistics, 1878-79. Vol. 8. Legal Documents, pp. 56-60.
182. Blair County Tax Lists, 1859; U.S. Census, 1860.

183. This analysis was based on data obtained from the 1859 Township Maps of Blair County, the U.S. Census for 1860, and the Blair County Tax Lists for 1859-60. The research team attempted to "walk" with the census taker, determining his daily route by plotting the known landowners on the 1859 Atlas and then extrapolating the general vicinity in which workers, not listed on the township maps, resided. Although a system with obvious pitfalls, the method provides a good hypothesis-building tool.

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188. Chapman, Thomas J. The Valley of the Conemaugh. Altoona: McCrum and Dern. 1865 p. 159-60.

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201. Ibid, p. 31; Annual Report of the Secretary of Internal Affairs, Bureau of Industrial Statistics, 1875-6, pp. 644-647.
202. First Annual Report of the Bureau of Statistics of Labor and Agriculture for the Years 1872-3; First Annual Report of the Secretary of Internal Affairs, Bureau of Industrial Statistics, 1874-5.
203. Bureau of Industrial Statistics, 1874-5. Harrisburg: B.F. Meyers, 1876. pp. 300-301.
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205. Annual Report of the Secretary of Internal Affairs, Bureau of Industrial Statistics, 1875-6. p. 697.
206. Blair Tax Lists 1859-1865, 1877-1879. The number of mules had already been reduced to 28 after the war.
207. Annual Report of the Secretary. Department of Internal Affairs, Bureau of Industrial Statistics, 1878-79. pp. 56-58.
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